SOVIET SPACE MYTHOLOGIES

SLAVA GEROVITCH

PUBLIC IMAGES, PRIVATE MEMORIES, & THE MAKING OF A CULTURAL IDENTITY

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To the memory of Maya

CONTENTS

Acknowledgments ix

Introduction: Creating Memories of the Space Age xi

1. **"Why Are We Telling Lies?":** The Construction of Soviet Space History Myths 1

2. **Stalin's Rocket Designers' Leap into Space:** The Technical Intelligentsia Faces the Thaw 27

3. **"New Soviet Man" inside Machine:** Human Engineering, Spacecraft Design, and the Construction of Communism 48

4. **The Human in the Arms of Technology:** Gagarin's Flight in Documents and Stories 68

5. **Human-Machine Issues, the Cosmonaut Profession, and Competing Visions of Spaceflight** 98

6. **The Human inside a Propaganda Machine:** The Public Image and Professional Identity of Soviet Cosmonauts 128

7. **Remembering the Soviet Space Age:** Myth and Identity in Post-Soviet Culture 155

Notes 171

Bibliography 213

Index 227

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INTRODUCTION

Creating Memories of the Space Age

THE Nobel Prize laureate Orhan Pamuk's novel, *The White Castle*, is a subtle reflection on the power of memory. Living in seventeenth-century Istanbul, two main protagonists—an Italian scholar and a Turkish noble—share their most intimate memories and gradually adopt each other's memories as their own. Their distinct identities begin to blur until they (and the reader) can no longer recognize who is who. Eventually they switch their original identities, as the power of memory overwhelms them. The Turk becomes a scholar and leaves for Italy, while the Italian abandons science to enjoy luxurious life at the sultan's court.[1] This parable suggests that our memories determine who we are, and manipulating these memories affects the very core of our identity.

Key events of the Space Age are especially memorable—this is why it is called "the Space Age" in the first place. The triumphs of Yuri Gagarin's first flight and Neil Armstrong's first step, and the tragedies of *Apollo 1*, Gagarin's death, *Challenger*, and *Columbia* are among recent generations' most vivid and emotional memories. But what do we really remember when we remember the Space Age? In 1986–88, the cognitive psychologist Ulric Neisser conducted a study of forty-four student subjects, who were asked how they first heard the news of the *Challenger* disaster. The first round of questioning took place the next morning after the event, the second round—with the same participants—two and a half years later. It turned out, none of the later accounts fully coincided with the original report, and over one-third were, as Neisser put it, "wildly inaccurate." Moreover, even when confronted with their own earlier written reports, the subjects were convinced that the later memory was true. The original memories quite simply disappeared from their minds.[2]

Recent research in cognitive, social, and clinical psychology and in cognitive neuroscience indicates that our memory is a much more dynamic and malleable process than previously thought. Our memories are not stored in a fixed form; we do not pull them out of a permanent storage and then put them back intact. According to the constructivist approach to memory, every act of recollection is re-creation, reconstruction of a memory.[3] Every time we "recall" a memory, we relive the event that caused it, emotionally relate to it, remake that memory, and store a new version, overwriting the old one. At the moment of recollection, the memory becomes unstable, and it can be modified

and even "erased," or a false memory can be planted.[4] Recalling something is essentially similar to making a new, original memory. "Recollection is a kind of perception," psychologists argue, "*and every context will alter the nature of what is recalled*."[5] As a result, we do not really remember the original event; we remember only our last recollection of that event. The more we remember and the more often we recall something, the more we reconstruct and alter that memory, getting farther and farther from the original event.

According to the school of "narrative psychology," linking individual memories into a coherent narrative, which supplies meaning to past events, plays an essential role in the formation of one's self.[6] As the neurologist Oliver Sacks has put it, "We have, each of us, a life story, an inner narrative—whose continuity, whose sense, *is* our lives. It might be said that each of us constructs and lives, a 'narrative,' and that this narrative *is* us, our identities."[7] When our present self constructs and distorts our memories of the past, the very fallibility of these memories serves a purpose—to establish continuity between our present and past selves. The literary scholar Paul Eakin has argued that memory is "not only literally essential to the constitution of identity, but also crucial in the sense that it is constantly revising and editing the remembered past to square with the needs and requirements of the self we have become in any present."[8]

We are what we remember, and this is equally true for individuals and societies.[9] The notion of *collective memory*, introduced by the French sociologist Maurice Halbwachs, stresses that individual memories are grounded in social interaction. By focusing on the notions of "collective memory" and "social memory," cultural history draws on the metaphor of society as a remembering subject, which constructs its identity based on collective remembrance and can go through a psychological "trauma" profoundly distorting collective memories.[10] Collective memory—culturally sanctioned and publicly shared representations of the past—shapes social identities and provides narratives through which individuals publicly describe their selves, remember the past, and interpret the present.[11]

When the constructivist model of individual memory is applied to cultural history, the implications are profound. Like individual memory, collective memory is continuously re-created, supplanting original memories with later versions. Cultural memory thus becomes self-referential: it feeds on itself and recollects its own recollections. The more a particular society or group remembers an event, the more intensely collective memory is at work, the more we mythologize and the more we forget. Remembering and mythologizing are the same thing. Just like false private memories reinforce the continuity of the individual self, cultural myths shore up national or group identity.

Taking seriously the view that culture is the myths we live by, historians

have focused on the cultural functions of collective myths—to structure and pass on historical memory, to create the basis for a dominant "master narrative," and to shape social identities. In this context, whether the myth is true or not is not particularly significant. What is important is the political and cultural force of cultural myths, whether ethnic, religious, or ideological—that is, their ability to act, to create a public appeal, to tell a story to identify with, and to forge an ideal to imitate.

The metaphor of society as a remembering subject may be misleading, as it obscures the active role of individuals in selecting, modifying, and combining various representations of the past and the dependence of these representations on the concerns and conflicts of the present. James Wertsch has proposed the term *collective remembering* to describe both narratives and nonverbal practices of commemoration.[12] Breaking down the umbrella term *collective memory*, Aleida and Jan Assmann distinguish between *communicative memory* and *cultural memory* by contrasting "living, embodied," autobiographical memory with culturally sanctioned remembrance, mediated by texts, symbols, and performances.[13] Communicative memory refers to passing everyday exchanges, such as jokes or gossip, while cultural memory is embodied in material objects and social customs. Cultural memory shapes group identity, provides tools for reconstructing the past, forms stable "heritage" formations, involves specialization and institutionalization, and serves educational, normative, and reflexive functions.[14]

Communicative memory actively interacts with cultural memory.[15] The institutionalization of cultural memory by nation states—the establishment of national archives, the public celebrations of various anniversaries, and the dissemination of favorable historical narratives—often serves the political purpose of reinforcing national identity and marginalizes individual memories and other social identities. Communicative memory reinterprets and devalues certain aspects of organized and ceremonial remembering practices, while private memories become "contaminated by national projects of remembrance."[16] The French cultural historian Pierre Nora argues that the old age of memory and tradition has given way to the new age of history and conscious narrative-construction. "Memory is constantly on our lips," he writes, "because it no longer exists."[17] Recent studies have focused on the origins of historical myths, their deliberate construction by political elites, and their repressive power to marginalize alternative stories and identities.[18]

Space history has its own recurrent myths. Comparing master narratives of space exploration in different national contexts, historian Asif Siddiqi has identified four common cultural archetypes, or "tropes," structuring these narratives: the myth of the founding father (in the Soviet case, Konstantin Tsiolkovskii), the myth of exclusively domestic space technology, the myth of

spaceflight as expression of national identity, and various stereotypical justifications for spaceflight—the destiny of humanity, glory for the nation, national security, economic development, scientific exploration, and benefits to the ordinary people.[19] Every nation develops its own variations, such as the American "myth of presidential leadership" and the triumphal "master narrative," accompanied by counter-narratives of right-wing, left-wing, and conspiracy-theory varieties.[20] The Apollo astronaut myth, as described by historian Roger Launius, features several key elements: the astronaut represents "everyman" yet personifies the American ideal, embodying the image of a masculine hero, a young, fun-loving, vigorous warrior, guided by an older, wiser leader, and showing the nation the path of progress toward utopian future.[21]

Like the Turk and the Italian in Pamuk's novel, who trade their identities by listening to each other's stories, the astronauts could hardly remain unaffected by their image in popular culture. A documentary titled *In the Shadow of the Moon* is composed entirely of interviews with Apollo astronauts, illustrated with fragments of archival footage.[22] The film is not organized as a collection of separate stories of individual missions; instead, it weaves together bits and pieces of astronauts' stories to create a meta-story that blurs distinctions among different missions and even among different astronauts. It is as if a composite image of the astronauts is telling a composite story of lunar landings. Another documentary, *The Wonder of It All*, uses a similar technique, interleaving commentaries from seven astronauts who walked on the Moon.[23] As one reviewer has noted, "the editing has been done so skillfully that instead of seven individuals talking, it seems more like one—each of them often continues a sentence that the other started."[24] Individual stories—and individual astronauts' identities—blend together seamlessly. How does this blending occur? Is this a trick of the filmmakers, or a fundamental cultural mechanism at work, in real life squeezing individual identities to conform to the dominant cultural stereotype of an astronaut? What happens to alternative memories? This artistic blending of memories may be viewed as a metaphor for society's erasure and overwriting of historical memory.

Soviet space myths showed remarkable similarity to their U.S. counterparts, with proper substitution: the New Soviet Man for the "right stuff," and the superiority of socialism for the superiority of capitalism. An important difference, however, was the Soviet erasure of any space failures from cultural memory. Bound by secrecy on the one side and by propaganda demands on the other, the Soviet master narrative of space history was reduced to a set of clichés: flawless cosmonauts flew perfect missions, supported by unfailing technology.

Unlike American public counter-narratives, Soviet counter-memories formed an oral tradition, completely separate from written accounts. Counter-

narratives are often associated with groups that are "excluded," "overlooked," or otherwise marginalized in historical accounts.[25] The counter-memories of Soviet space history, however, were cultivated by well-known public figures (cosmonauts) and by elite technocrats (space engineers), creating a tension between their private memories and their public personas. For example, the perceived need to conform to his sterilized public image made Gagarin into a "sincere deceiver," a skilled practitioner of "truth-lie."[26] "True stories" of events hashed up or distorted in official accounts were passed on from one generation of cosmonauts and space engineers to another, giving rise to counter-myths and forming the communicative memory of their professional groups. Counter-memories defined their private identity as much as the master narrative shaped their public image.

Spreading beyond the space community, the counter-memories mixed with public sentiment, which ranged from sheer enthusiasm to profound cynicism. This mixture gave rise to many urban mythologies—from the tale of Stalin's personal founding of the Soviet rocket industry to conspiracy theories of Gagarin's death to political jokes about overzealous cosmonauts and ignorant politicians.[27]

This book explores the interplay of cultural and communicative memory, examining a wide range of Soviet cultural practices of remembering the Space Age from the 1960s through perestroika to the post-Soviet era—from published reminiscences to public rituals to official histories. In the Soviet context, despite the stereotypical picture of top-down control of historical discourse, the boundaries between different forms of cultural memory were highly permeable, and multiple actors with diverse methods and goals participated in myth making.[28] In the semi-private spaces of the highly secretive space industry, the communicative memory of veterans' stories mixed with the symbolism of public rituals and formed the cultural memory of the space engineers and the cosmonauts. In these intermediate memory spaces—between the private and the public, between the informal and the official, and between technology and politics—memories hidden from the outside world were widely shared. Drawing on private diaries and interviews with space program participants, this book argues that both myths and counter-myths played a constructive cultural role by providing a set of shared tropes and references for public discourse, by shaping the identities of cosmonauts and space engineers, and by either embodying or challenging officially declared Soviet values.

Chapter 1 explores the formation of key myths of the Soviet space age, such as the Korolev myth and the cosmonaut myth, focusing on memoirs and commemorative events as cultural vehicles for mythologization of history. Officially disseminated Soviet space myths greased the wheels of the propaganda machine, gave tangible representations to the ideological concepts of

socialism and nationalism, and cemented the identity of a nation. Rather than seeing Soviet space myths as pure propaganda tools, this chapter examines them as a function of Soviet remembrance practices, both public and private. The space myths were not entirely constructed from above. Various historical actors—from the cosmonauts to space engineers to military officials to artists to the general public—introduced their own elements into space mythology, and these were not necessarily consonant with the official version.

The next chapter examines the impact of the professional culture of rocket engineering in late Stalinism on the engineering and organizational practices of the space program during the Khrushchev era. The Stalinist legacy and the dual military/civilian character of rocket engineers' work profoundly affected the identity of this elite part of the Soviet technical intelligentsia. Focusing on such notions as control, authority, and responsibility, this chapter examines the role of engineering culture in shaping the Soviet approach to the automation of piloted spacecraft control. Drawing on Stalin-era techniques of patronage and networking, space engineers of the Khrushchev period were able to overcome the inefficiency of Soviet industrial management and to advance their agenda of space exploration.

Chapter 3 explores the tension between the public image of Soviet cosmonauts and their professional identity. Soviet propaganda often used the Soviet space program as a symbol of a much larger and more ambitious political/engineering project—the construction of communism. Both projects involved the construction of a new self, and the cosmonaut was often regarded as a model for the "New Soviet Man." The Soviet cosmonauts publicly represented a communist ideal, an active human agency of sociopolitical and economic change. At the same time, space engineers and psychologists viewed human operators as integral parts of a complex technological system and assigned the cosmonauts a very limited role in spacecraft control. This chapter examines how the cosmonaut self became the subject of "human engineering" and draws parallels between the iconic roles of the cosmonaut and the astronaut in the Cold War context.

Chapter 4 interweaves documents and stories about Gagarin's pioneering spaceflight. The official narrative of Gagarin's mission became a success story, and all the details that complicated the picture were purged from the record. Censors duly screened every publication, weeding out any disclosure of technical failures or social tensions related to the mission. In the official version, Gagarin's flight had no glitches, except for the little snag with an improperly closed hatch at the launch pad, which was quickly fixed. A sanitized version of Gagarin's flight communications transcript was published; a version sent to the Communist Party leadership was similarly edited. Before the Soviet leadership deceived the world for propaganda purposes, the management of

the space program attempted to hide technical and managerial errors from the Soviet leadership. Through memoirs, diaries, and documents, this chapter gives voice to conflicting accounts by many participants and observers, creating a multifaceted picture of myth in the making.

Chapter 5 focuses on the seemingly technical debates over the proper degree of automation of spacecraft control. These disputes were crucial to the definition of cosmonauts' requisite skills as either pilots or engineers. Here technology, professional identity, and social status became closely intertwined. Soviet cosmonauts were "designed" as part of a larger technological system; their height and weight were strictly regulated, and their actions were thoroughly programmed. In the absence of a long-term space policy, their missions were usually designed with short-term goals in mind, often without respect for human engineering specialists' advice. Soviet space politics, one might say, was inscribed on the cosmonauts' bodies and minds, as they had to fit, both physically and mentally, into their spaceships. The issue of onboard automation also raised larger questions of the meaning and purpose of human spaceflight. The debates over automation reflected competing visions of spaceflight as either a piloting mission or a research enterprise.

The next chapter is devoted to the tension between the public image and the professional identity of Soviet cosmonauts. The cosmonaut myth was conceived as novel, forward-looking, and high-tech, yet it was constructed out of traditional elements of Soviet propaganda. The medium—the old and clunky propaganda machine—subtly undermined the futuristic message. And the messenger, the cosmonaut, felt ambivalent about the message. All the questions that most interested the cosmonauts—the technological aspects of spaceflight, the emergencies in orbit, and plans for future flights—had to be left out of their public speeches. The cosmonauts were forced to follow the preset agenda of the space propaganda machine, just as they had to fit into the automated control system of their spacecraft. Neither machine left them much room for initiative. Just as they tried to broaden their control over spacecraft, the cosmonauts tried to gain greater control over their social role. Just as they were not perfect automatons on board, they were not ideal models in the social arena.

The last chapter focuses on the interplay of myth and identity in post-Soviet culture. In today's Russia, which has lost its former communist ideals and is still searching for a unifying "national idea," Gagarin's pioneering flight—the pinnacle of the Soviet space program—often stands as a symbol of history that the Russians could really be proud of, despite the trauma of losing the superpower status. Space history now becomes part of what the cultural critic Natalia Ivanova has termed "no(w)stalgia": neither condemnation nor idealization of the past, but its actualization as a set of symbols that provide

reference points for today's discussions.[29] In post-Soviet Russia the cultural heritage of the decades of the communist rule oddly mixes with the newly developing capitalist culture, as advertising campaigns often skillfully combine old Soviet symbolism with "new Russian" capitalist values.

The story of Soviet space mythology suggests a more complicated picture than the mere suppression of informal communicative memory by state-sponsored cultural memory. While the official history of the Soviet space program presented a mythologized version of events, space engineers and cosmonauts who cultivated "counter-memories" produced their own myths. Ironically, often the same people—flown cosmonauts and space engineers—propagated both types of myths but in different spaces of memory: the former publicly, the latter privately. In the cultural swirl after the collapse of the Soviet Union, as former idols were dethroned and former outcasts canonized, the neat analytic distinctions between public and private discourses, between communicative and cultural memory, and even between memory and history became blurred. The choice is no longer between history and memory but, rather, among the different versions of myth.

SOVIET SPACE MYTHOLOGIES

1 "WHY ARE WE TELLING LIES?"

The Construction of Soviet Space History Myths

THREE PHOTOGRAPHS AND THREE TYPES OF STUDIES

In May 1961, soon after Yuri Gagarin's pioneering spaceflight, the first group of Soviet cosmonauts was vacationing at a Sochi resort. Sixteen of them leisurely posed for a group shot, which later became an iconic photograph of the Soviet Space Age.[1] The version published much later in Soviet media, however, had only eleven cosmonauts in the frame—only those who made it into the spotlight after their flights. Five others did not get their chance to fly in space and were erased from the visual record of the space program. Among them, for example, was the cosmonaut trainee Grigorii Neliubov, Yuri Gagarin's second backup, the third in line to go to space. After an argument with local police, he was expelled from the cosmonaut corps, fell into depression, and eventually committed suicide.[2] His name surfaced only with the advent of perestroika and glasnost, when the media were flooded with startling revelations about the Soviet space program from space program veterans—cosmonauts, engineers, and the military—who began showering the public with interviews and memoirs. In that period, the study of Soviet space history was dominated by journalists and space history buffs. They were typically interested in filling in gaps in the official record—failed missions, onboard emergencies, launch-pad disasters, dead cosmonauts, and secret programs. Such studies were akin to the restoration of a vanished cosmonaut on a group

photo: they added missing pieces of the puzzle but did not change the configuration of the puzzle.[3]

Another iconic image depicts Chief Designer Sergei Korolev saying goodbye to Gagarin at the launch pad on April 12, 1961. This photograph was also doctored. This time, it was not a culpable cosmonaut, but the Commander of the Strategic Missile Forces Marshal Kirill Moskalenko who was wiped out.[4] The military personnel were routinely erased from publicly released photographs to present the Soviet space program to the world as entirely civilian and peaceful. Such manipulations did not simply remove a piece of the puzzle; they changed the configuration of power in the group. Analyzing the role of the military and examining the relationships among the different constituents of the program—the space engineers, the cosmonauts, the military, and the politicians—became the focus of a second group of studies by professional historians, which came after the first wave of revelations. In the 1990s, these historians began questioning some of the basic assumptions about the Soviet space program: What was driving the Soviet efforts in space? How did the division of power among the different groups affect space policy decisions, technological solutions, and the conduct of space missions? What shaped the professional cultures and identities of the space program participants?[5]

Finally, in the 2000s, a third group of studies ventured into the realm of questions about the broad meaning of the Soviet space enterprise in a larger social and cultural context: Who has constructed the appealing mythology of Soviet space triumphs in popular imagination, how was it constructed, and why? Why did this mythology resonate so much with the public sentiment? What was the relationship between state-sponsored propaganda campaigns and the widespread cosmic enthusiasm? What does the popular fascination with space exploration tell us about the hopes and anxieties of Soviet people in the post-Stalin era?[6]

New studies do not so much discover new secrets as they reveal how the secrecy regime operated, and how new myths arose in the discursive gaps created by secrecy. Historian Iina Kohonen has looked at the photographic record of the Soviet space program not for the sake of finding vanished cosmonauts but in order to reconstruct the underlying assumptions that went into the construction of visual record and to detect the embedded ideological messages—in other words, to compile the grammar of Soviet visual propaganda. In particular, she has studied the iconic photograph of Gagarin walking on red carpet after the triumphal arrival in Moscow upon the completion of his spaceflight. Many witnesses recalled a funny detail: the shoelace on Gagarin's right shoe came loose, and Gagarin had to walk very carefully not to step on the shoelace and not to stumble.[7] Kohonen argues that the photo was retouched to remove the traces of the offending shoelace.[8] This looks like

a very minor detail compared to the gigantic state-sponsored disinformation campaigns about Soviet achievements, intentions, and capabilities in space. Still, it encapsulates the contemporary practices of constructing an idealized, "clean" image of the Soviet space program for the historical record. It is precisely the practices of cultural construction and transmission of space mythology that are the focus of this chapter.

MYTHS AND COUNTER-MYTHS

On January 17, 1969, *Soyuz 4* landing module softly touched down in Kazakh steppe. When the mission commander Vladimir Shatalov began climbing out of the spacecraft, someone suddenly shouted, "Where are you going?! Get back!" It turned out that a cameraman did not have time to point his camera at the scene. Shatalov obediently squeezed back into his capsule and then reemerged, properly smiling and waving.[9] The historic moment was captured on film and preserved for posterity. By climbing out of his spacecraft Shatalov left the realm of history and entered a myth.

Myth making was part of a venerable tradition of Soviet propaganda. Soviet leaders sought legitimacy of their power and validation of current policies in the construction of historical breaks and continuities, in the overthrow of former idols, and in the creation of new ones. The promotion of state-sponsored myths of the October Revolution and the Great Patriotic War was accompanied by a systematic suppression of contradictory private memories, which often gave rise to counter-myths, such as the Great Terror and the Thaw. The term *myth* is used here without implying the truth or falsity of any particular historical claim but merely to stress the foundational, identity-shaping character of such claims. Recent scholarship has increasingly focused on the interplay of official discourse and private memories and on the active role of multiple actors in political and cultural appropriations of memory.[10]

The Soviet space program occupies a prominent place in postwar Soviet history—as a formidable technological project, a significant military development related to intercontinental ballistic missiles (ICBMs) and reconnaissance, and a political and cultural symbol of Soviet achievements or failures. Through the prism of space history, one can observe major political and cultural shifts. Changing priorities of Soviet space policy reveal a larger Cold War agenda; popular representations of spaceflight reflect Soviet ideological constructions of science and technology; the cosmonauts' public image reifies the abstract concept of the New Soviet Man; and private discussions of space failures indicate the degree of mass skepticism of official propaganda. The Soviet space program played such an outstanding symbolic role due to the systematic efforts of different agents to create and disseminate space myths, suppress counter-memories, and privately cultivate counter-myths.

Soviet space utopianism could be traced back to the tradition of Cosmism, a philosophical and cultural movement of the early twentieth century, which attached spiritual meaning to the colonization of space.[11] Science fiction writings and popular science works also contributed to the prerevolutionary public fascination with spaceflight. The Bolshevik Revolution did not produce a major break in this tradition but merely energized these trends by adding a utopian technological component.[12]

The Soviet space program—perhaps an ultimate expression of "technological utopianism"—expanded the Soviet aspirations to dominate and transform nature for human ends from the earthly endeavors of industrialization and collectivized agriculture into the boundless realm of outer space.[13] Instead of the American phrase "space exploration," the Soviets widely used the terms *conquering* (*pokorenie*) and *mastering* (*osvoenie*) of space. The Soviet space firsts of the 1950s and 1960s—from *Sputnik* to Gagarin to Tereshkova—were quickly turned by Soviet propaganda into tangible proofs of the technological and political superiority of socialism and major pillars of the cult of science and atheist propaganda. To boost its political and moral legitimacy, the Soviet regime sought to imprint the space triumphs in cultural memory, to turn them into powerful historical myths, and to suppress any interfering counter-memories. The Soviet public did not passively receive these messages. Responses ranged from patriotic enthusiasm to celebrity furor to eager consumerism to sarcastic jokes to utter indifference.[14]

The Space Age produced vivid memories and engaging stories. Individual retelling of these stories and collective propaganda projects of remembrance gradually transformed historical events into mythological epics, shaping the identity of generations. The "*Sputnik* generation" of Soviet citizens, who grew up in the 1950s, in recent interviews acknowledged the formative role of the key events of the Space Age, even though they had little personal recollection of *Sputnik* or Gagarin's flight.[15]

This chapter explores the dynamics of cultural memory of the Soviet Space Age, focusing on memoirs and commemorative events as cultural vehicles for the mythologization of history. It examines the construction of a state-sponsored master narrative as a heroic tale of fearless cosmonauts and omnipotent engineers, which excluded any mention of spaceships' technological failures or cosmonauts' moral failings.[16] The official version of events often clashed with counter-memories that circulated privately among cosmonauts and space engineers.

Although counter-narratives are usually associated with groups that have limited access to mainstream discourse, the counter-memories of space history were often cultivated by well-known public figures (cosmonauts) and by elite technocrats (space engineers), creating a tension between their private

memories and public personas. The circulation of these private memories gave rise to counter-myths, whose preservation and passing on to the next generation through group folklore became an integral part of the professional culture of the space program. Instead of seeing Soviet space myths as pure propaganda tools, here they are treated as a function of Soviet remembrance practices, both public and private.

THE SPACE AGE IN AMERICAN CULTURE

The cultural historian Emily Rosenberg has suggested a useful system of coordinates to analyze the role of the Space Age in American culture: a four-dimensional space of politics, the media, philosophy, and the arts. The *Sputnik* shock and the perceived "missile gap" boosted Cold War anxieties, and these anxieties, in turn, gave a spur to the space race. The media were enrolled in the ideological "battle of appearances," turning astronauts into international celebrities and making spacecraft launches and television broadcasts from space into spectacular public events. The idea of technocracy gained support, and technological elites accumulated economic and political power, while "counterculture" chose the Spaceship Earth image to promote environmental consciousness and a new global identity, which transcended the political boundaries of a nation state. In architecture, product design, and abstract expressionist painting, new space-inspired shapes and color palettes captured the spirit of a "new frontier" of space in the aesthetic of self-confident progress, futuristic automation, and individual adventure.[17]

The dynamics of the relation between spaceflight and the media stresses the active, instrumental role of culture in shaping the Space Age. NASA skillfully used the media to create and disseminate a favorable public image of the U.S. space program, and at the same time space technologies engendered a technological revolution in visual media, making electronic communications truly real-time and global. Rosenberg argues that a "synergy" emerged between the Space Age and the Media Age: spaceflight acquired its spectacular character, while the media thrived on new popular subjects of interest and on the advanced technologies. Wider culture did not simply reflect developments in the space program; it became a vehicle for specific agendas within the space program.

Rosenberg's analysis highlights tensions and contradictory trends in different aspects of the Space Age culture. The Space Age brought about the space race, which both challenged national pride and was enrolled to boost it. The Space Age gave birth to mammoth technological projects and raised concerns about uncontrollable government spending. It created a cult of technology and awoke suspicions about the attempts to find technological solutions to political problems. It trumpeted rationality and gave rise to various forms of

spirituality. It was wrapped in the rhetoric of global unity and peaceful cooperation, and it led to the militarization of the heavens. It unleashed fantasy in the arts and regularized engineering creativity with systems engineering management techniques. It gave rise to both exciting and frightening visions of the future.

What were the cultural mechanisms that selected specific iconic images, prominent figures, and big ideas that came to occupy a central place in the public memory of the Space Age? Recent literature begins to tackle the question of how—of all the variety of different visions of the Space Age—only a few have survived as the dominant symbols of the era, while others were marginalized and forgotten.[18] As the space historian Roger Launius has argued, the American "master narrative" of spaceflight incorporates the mythology of "limitless frontier," the popular image of the "heroic explorer," and futurist visions to tell the story of American triumph in the space race, exceptionalism, and success. Three counter-narratives have also emerged: the left-wing criticism of spending funds on space instead of social programs, the right-wing criticism of the space program as an excessive government expense, and various conspiracy theories of secretive space militarization schemes, alien abductions, and the like.[19] The competition among the master narrative and the three counter-narratives might provide a template for analyzing the clash of diverse cultural representations of the Space Age outlined by Rosenberg. Each narrative plays out in public discourse through literature, imagery, film, and other media. The competition among Space Age symbols serves as a proxy for the battle of the narratives.

A number of seminal works have explored the relationship between NASA and popular culture. The political scientist Howard McCurdy has examined the links between popular conceptions of space exploration and national space policy, focusing on NASA's deliberate exploitation of the frontier myth and the utopian visions of social progress through technological means and its encouragement of the Cold War fears of Soviet domination. As the space program after Apollo changed its character, it no longer matched the popular expectations inherited from the previous era. The gradual disillusionment with the NASA space program since the 1970s could be traced to a widening gap between popular sentiment and the reality of spaceflight.[20] The cultural theorists Marina Benjamin, Constance Penley, and others have studied how popular culture responded to the Space Age by reinterpreting NASA's symbolic imagery and generating competing discourses.[21] Broader culture turns space images, artifacts, names, events into "floating signifiers"—symbols without fixed meaning—which are reinterpreted again and again as they pass through different contexts. No single group or agency—even a government agency—can fully control them.

From a cultural anthropologist's perspective, the interaction between NASA and broader culture could be recast as a dialogue of different cultures: NASA's own culture(s) and the diverse subcultures of space fans, activists, educators, and artists. A study of this interaction might finally bring together two disparate research areas—the analyses of the Space Age in popular culture and the studies of NASA's own institutional culture(s).[22] The anthropological models of cultural contact, conflict, translation, mediation, and the "trading zone" may prove useful here.[23]

Combining the notion of historical memory with the model of cultural exchange leads to an investigation of the dynamics of memory in different cultures. Within larger American culture, every distinct group—space engineers, astronauts, and space fans, for example—nurtures its own memories, its own folklore, and its own historical visions of the Space Age. When different groups interact and exchange their memories, new mythologies and hybrid identities might emerge.

Although different groups and different nations may have different memories of the Space Age, the cultural mechanisms by which these memories are exchanged and altered over time, prove remarkably similar. If we look beyond American culture and examine the convolutions of the historical memory of the Space Age in Russian and Soviet culture, we will find a similar struggle between a master narrative and an array of counter-stories, even though the dynamics of this struggle will follow a specifically Russian political and cultural trajectory.

RUSSIAN SPACE MEMORIALIZATION

Memories of the Space Age occupy a prominent place in contemporary Russian culture. In 2007 alone, the Russians celebrated the centennial of the legendary Chief Designer Korolev, the 150th anniversary of the space visionary Konstantin Tsiolkovskii, the 120th anniversary of the Soviet rocketry pioneer Fridrikh Tsander, the 50th anniversary of the R-7 intercontinental ballistic missile designed by Korolev, and finally, the 50th anniversary of *Sputnik* and of Laika's flight on *Sputnik 2*. Yet one anniversary was barely noticed: the ill-fated *Soyuz 1* mission, which ended forty years previously in a crash and the tragic death of the Soviet cosmonaut Vladimir Komarov. That year, 1967, was a significant turning point in Soviet cultural attitudes toward spaceflight: from admiration and pride to grief, cynicism, and, ultimately, indifference. Yet this memory is overwritten by a different, pride-boosting version of history.

The cultural trope of the founding father, as Siddiqi has pointed out, still dominates the Russian cultural perceptions of the Space Age. In January–February 2007, a large conference was held in Moscow to commemorate Korolev's centennial. The conference had 1,650 participants; over 1,000 papers

FIGURE 1.1. Monument dedicated to Sergei Korolev's alleged 1929 visit to Konstantin Tsiolkovskii in Kaluga, unveiled in April 2011, on the fiftieth anniversary of Gagarin's flight. Sculptor Aleksei Leonov (cosmonaut Leonov's namesake). Tsiolkovskii is made to look younger, and Korolev older, than in 1929, to match their other iconic images. Image courtesy of Boris Mavlyutov.

were submitted, and 420 were selected for oral presentation at the conference in twenty sections running in parallel over four days.[24] Although not all the papers were historical (many were devoted to current issues in astronautics), several sections were entirely devoted to space history. Such academic conferences have been organized every year; the thirty-ninth annual Korolev conference was held in January 2015. Similarly, every April, conferences dedicated to Gagarin are held in his birthtown; in 2014, the fortieth Gagarin conference took place. In addition, every September the town of Kaluga organizes Tsiolkovskii conferences, with the forty-ninth conference organized in 2014. The general mood at such conferences is celebratory: veteran cosmonauts wear their ceremonial uniform, dancers in ethnic Russian costumes provide a suitable patriotic background, and Korolev's (or Gagarin's, or Tsiolkovskii's) portrait dominates the stage. During the Korolev conference, a new monument to Korolev was dedicated at the conference site, the Bauman State Engineering University in Moscow. Giant portraits and dominating, larger-than-life monuments serve as symbolic beacons for historical discourse. These conferences

provide a suitable setting for hero-worshipping, rather than critical analysis. A chosen set of historical figures—Korolev, Tsiolkovskii, and Gagarin—serve as sources of light rather than subjects of study, at whom light should be directed.

This weaving of space history around a handful of key personalities was characteristic of Soviet space history from its early days. If Korolev has been traditionally portrayed as the "founding father" of Soviet cosmonautics, Tsiolkovskii might be christened its "founding grandfather." A deaf schoolteacher in the provincial town of Kaluga, Tsiolkovskii was a self-taught theorist and visionary of space travel. In the 1910s–1930s, his writings widely circulated in the growing Russian community of space travel enthusiasts. After the revolution, Tsiolkovskii skillfully employed Bolshevik rhetoric to fashion himself as a sufferer under the tsarist regime and a thinker of a Marxist bent in order to gain support from the Soviet government. The government, in turn, constructed its own propaganda image of Tsiolkovskii. In the 1930s, the Stalin propaganda machine molded him into a national hero, a poster boy for national technological superiority. This ascribed identity was quite different from his own cultivated image of a humble provincial inventor, science popularizer, and public educator, who built rocket models in his home workshop.[25]

In the postwar period, Soviet rocket engineers and space enthusiasts put the government-constructed myth to their own use. In the late 1940s, the name of late Tsiolkovskii was regularly evoked amid a Party-sponsored nationalist campaign asserting the priority of Russian-born scientists and engineers. Journalists began to claim that Tsiolkovskii had even invented the airplane and the dirigible.[26] On September 17, 1947, on the ninetieth anniversary of Tsiolkovskii's birth, Korolev gave a speech at a commemoration meeting in the Central Hall of the Soviet Army. As Siddiqi has noted, "significantly, Korolev drew attention to Tsiolkovskii's ideas about space travel rather than rocketry or airships, thus beginning the process of relocating Tsiolkovskii within space research rather than aeronautics."[27] Suddenly, Korolev and other rocket engineers interested in space exploration began to recall their prewar meetings with Tsiolkovskii and to present their space projects as "inspired" by him. Pilgrimages to Kaluga to meet with the great man came to be seen retrospectively as a "rite of passage" for any major figure among the rocket engineers. A symbolic link with Tsiolkovskii, canonized by the Soviet state, played an important role in legitimizing their proposals in the eyes of government officials. In 1952–1953, in autobiographical materials accompanying his applications for membership in the Communist Party and in the Soviet Academy of Sciences, Korolev wrote about his personal meeting with the late visionary as being a starting point for his interest in rocketry. Even though he had met Tsiolkovskii only once, in 1932 during the latter's visit to Moscow, the

story later became embellished to the point of Korolev's vivid recollection of a visit to Tsiolkovskii's house in Kaluga—a visit, which evidently never happened.[28] Privately, Korolev admitted that he barely remembered Tsiolkovskii, and that the main source of his recollections was his own "fantasy."[29] Yet the official canonization of Tsiolkovskii and the resurrection of his legacy played a crucial role in legitimizing the idea of space exploration in the postwar Soviet Union. By turning a government-sponsored myth into a personal memory, Korolev managed to present his space projects as a matter of national prestige and eventually to secure government permission to launch *Sputnik* shortly after the centennial of Tsiolkovskii's birth.[30]

Cold War–era historiography largely treated popular Soviet discourse on science and technology as part of state propaganda, but Siddiqi makes a strong case for reevaluating such simplistic notions. The *Sputnik* story suggests that the Soviet space fad was initiated by well-connected groups of space enthusiasts who used government-controlled media channels to further their own agenda, which had little to do with the state's political or ideological priorities. Moreover, instead of passively accepting state-imposed propaganda, the popular Soviet fascination with spaceflight directly affected the top-level decision to launch *Sputnik*. Shifting the agency from the bureaucratic apparatus to informal networks of space enthusiasts, Siddiqi argues that the Soviet state followed, rather than directed, mass enthusiasm for space exploration.

Once the propaganda value of the space achievements became apparent, the Party and the government launched an incessant campaign to promote space enthusiasm. The discourse of space exploration became dominated by the iconic images and buzzwords tirelessly reproduced by the Soviet propaganda machine.

MYTHOLOGIZING COSMONAUTS

A handful of flown cosmonauts stood both literally and figuratively—literally, on the rostrum of the Lenin Mausoleum next to the then-current Party leader, and figuratively, in media representations—for the entire space program. Staged events, such as welcoming ceremonies at Vnukovo Airport and Mausoleum appearances, produced iconic images of the space era, widely disseminated through television, newspapers, posters, and postcards. Appearing next to the cosmonauts, Soviet leaders basked in their glory and in the meantime loaded the historical record with politically sensitive imagery. When leaders changed, the historical record had to be adjusted accordingly. In the Khrushchev era, Gagarin and Nikita Khrushchev always appeared together in the documentary footage of Gagarin's welcome; the scenes without Khrushchev were ruthlessly cut from the video. When Brezhnev came to power, filmmakers had to do the opposite: they discarded the scenes with

disgraced Khrushchev and instead dug up the previously cut scenes and made them a new visual canon.[31] The construction of the Gagarin cult was similarly accompanied by systematic edits in the official version of his biography and in his own writings.[32]

The media focus on the cosmonauts' young, photogenic, smiling faces produced a series of erasures in the cultural memory of the space era, which were quickly filled with myths. First, space engineers were prominently absent from public view. The public face of the Soviet space program was just the tip of a giant iceberg whose main body was buried deeply in the bowels of the military-industrial complex. The design and production of space rockets and spacecraft was, at least initially, a secondary mission of design bureaus and plants making Soviet ICBMs. The secrecy regime of the Soviet defense industry fully applied to the space enterprise. An official Party and government decree directly prohibited any public appearances or disclosure of the names of top space managers and leading engineers, including many chief designers. Media spotlight shone on trusted spokespersons, often totally ignorant of actual Soviet space activities, and on celebrated hero-cosmonauts.[33] This public representation inverted the actual power hierarchy within the space enterprise, in which the engineers were the decision makers and the cosmonauts played a subordinate role.

Second, similarly absent were realistic depictions of space rockets and spacecraft. As the booster rockets were merely upgraded ICBMs, space artifacts were also carefully concealed from public view. Cosmonauts were routinely portrayed with imaginary rockets in the background. Again, the public representation here inverted the actual human-machine relationship. The public image of the cosmonauts as fearless explorers manually guiding their spaceships into the unknown directly contradicted their professional experience. The real cosmonauts were thrust in the middle of a complex technological system and were severely limited in their manual control options.[34]

Third, the spaceflights themselves remained shrouded in mystery. With the boundaries of secrecy somewhat blurred, all spokesmen, including the cosmonauts, tried to avoid the risk and to disclose as little as possible. Cosmonauts' public accounts of their flights were remarkably uninformative. The cosmonauts spoke at length about floating in zero gravity but did not discuss any details of their training or actual performance in flight. This gave rise to much speculation about their experiences in space, from incapacitating sickness to spiritual visions.

Speaking publicly about the Soviet space program under such severe secrecy restrictions posed a serious challenge. Siddiqi has identified three basic discursive strategies developed by Soviet space propaganda to steer clear of any threat of state secret disclosure: elimination of contingency (success

is inevitable and failure impossible); "limited visibility" (focus on very few selected actors and artifacts); and construction of a "single master narrative" with "heroic and infallible" central characters.[35] Secrecy was just one of the factors contributing to myth making by creating gaps to be filled with products of one's imagination. Another factor—political propaganda—acted in a productive mode by generating tropes on which myths could be built. When placed on top of Lenin's mausoleum, the cosmonauts stood not merely for the Soviet space program but for a much larger enterprise—the construction of communism.

In October 1961, only six months after Gagarin's pioneering flight and two months after Gherman Titov's full day in orbit, the Twenty-Second Party Congress was held in Moscow. With much fanfare, the Congress adopted a new Party program, which set the goal of building a communist society in the Soviet Union within the lifetime of a generation. The program's two crucial components included the construction of the material and technical basis of communism and the education of the New Soviet Man, who would "harmoniously combine spiritual wealth, moral purity, and a perfect physique."[36] Who better than the cosmonauts could embody this new ideological construct? The Soviet media quickly generated a propaganda cliché: "the Soviet cosmonaut is not merely a conqueror of outer space, not merely a hero of science and technology, but first and foremost he is a real, living, flesh-and-blood *new man*, who demonstrates in action all the invaluable qualities of the Soviet character, which Lenin's Party has been cultivating for decades."[37]

In conformity with the ideological signals from the top, the idealized descriptions of cosmonauts' personal qualities in the media closely followed the "Moral Code of the Builder of Communism" from the new Party program. The Code touted such ethical imperatives as "love of the socialist motherland," "conscientious labor for the good of society," "a high sense of public duty," "collectivism and comradely mutual assistance," "moral purity, modesty, and unpretentiousness in social and private life," and "mutual respect in the family, and concern for the upbringing of children."[38] This moral ideal looks suspiciously similar to the poster-ready list of Gagarin's personal traits compiled by Evgenii Karpov, the head of the Cosmonaut Training Center: "Selfless patriotism. An unshakable belief in the success of flight. Excellent health. Inexhaustible optimism. The flexibility of mind and inquisitiveness. Courage and determination. Carefulness. Diligence. Endurance. Simplicity. Modesty. Great human warmth and attention to people around him."[39] The descriptions match a bit too perfectly, suggesting that cosmonaut biographers were thoroughly informed about the tenets of political discourse. At the same time, Gagarin seemed to be specifically selected to match the myth he was to embody.[40] Just in case, the authorities combed through the archives and con-

fiscated family mementos to remove any evidence contradicting the idealized public image of Gagarin.[41]

The public image of the cosmonauts was not produced by a single agency but, rather, by a multiplicity of agents, not necessarily working in unison. A key role belonged to Lieutenant General Nikolai Kamanin, an Air Force official in charge of cosmonaut selection and training. He controlled immediate access to the cosmonauts, managed the schedules of their public appearances and foreign trips, wrote their speeches, rehearsed them, and corrected their "errors." Kamanin was a legendary Soviet aviator, a household name in the Soviet Union in the 1930s. In 1934 he was among the first recipients of the newly established title of Hero of the Soviet Union for the daring air rescue of the crew of the *Chelyuskin*, an exploration ship crushed by the Arctic ice.[42] Among other famous aviators, he was held up as a role model for the young generation in the 1930s. Now he made his own experience as a cultural icon of the Stalin era into a model for his efforts to shape the cosmonauts' public persona. Thus, the myth of Soviet cosmonauts in many respects followed the precepts of Stalin-era glorification of Soviet aviators, who represented the New Soviet Man in the 1930s.[43]

Ghost-written cosmonaut biographies largely imitated Kamanin's own 1935 autobiography, written when he was twenty-six or twenty-seven, about the same age as the cosmonauts. The biographies featured an obligatory set of points of passage: humble beginnings, childhood burdened by wartime hardship, encouragement by the family and teachers, good education paid for by the Soviet state, a wise mentor who taught the core communist values, loyal military service, building up character and physical strength through a "trial of fire," receiving an important mission from the Communist Party, achieving the lifetime dream by carrying out that mission, and finally coming back with an important message reaffirming the abovementioned values. Both Kamanin's and cosmonauts' biographies contained little detail about the feats themselves but were rich in expressions of gratitude to the Party for inspiration and support. The father figure of omniscient Stalin, prominent in Kamanin's account, was gently replaced in cosmonaut biographies with the equally omniscient "Chief Designer" of the space program.[44]

With a devastating war fresh in the people's memory, the first cosmonauts—all young fighter pilots—inevitably evoked the imagery of warriors in combat. As the cultural historian Svetlana Boym has noted, "Soviet space exploration inherited the rhetoric of war; it was about the 'storming of space,' and the cosmonaut was the peacetime hero who was ready to dedicate himself to the motherland and, if necessary, sacrifice his life for her sake."[45] The martial rhetoric of space conquests also drew on earlier cultural memories: even in prerevolutionary Russia, aviators were traditionally depicted as "con-

querors of the air," direct descendants of Russian fairy-tale warriors.[46] Placing space exploration in this traditional context ensured the symbolic association of spaceflight with national pride. While introducing cosmonauts at public meetings, Kamanin often presented them as heirs of wartime heroes.[47] Applying war rhetoric to spaceflight, however, produced some tension. The Soviet human space program was declared to be entirely peaceful, and the cosmonauts' military uniforms seemed to be sending a contradictory message. The space program leadership was divided over the issue of military-related imagery. The question whether the first woman cosmonaut, Valentina Tereshkova, should be dressed in uniform or in civilian clothes on her official photo had to be decided by the Party Central Committee. In the end, Tereshkova appeared on the photo in civilian dress.[48]

The conquest of space became symbolically associated with the Soviet victory over Nazi Germany. A typical biography pictured Gagarin in his capsule, preparing for his flight and listening to music, which evoked memories of his childhood: life under Nazi occupation, war privations, and the joy of liberation by Soviet soldiers.[49] This ideological appropriation of private memories quite creatively reinterpreted Gagarin's actual experiences. As a boy, Gagarin indeed survived the occupation, but he reportedly had to hide this fact while applying to a flight school; this "dark spot" in his biography could have prevented his admission.[50] He later wondered how the authorities allowed him to become a cosmonaut, even after learning about the fact.[51] And the music he listened to during the preparations for his flight could hardly evoke elevated patriotic feelings: he actually listened to *Lilies of the Valley*, a popular love song, whose lyrics cosmonauts parodied, turning it into a drinking song.[52]

The cosmonaut myth played a major role in Khrushchev's attempts to de-Stalinize Soviet society and to reconnect with the original revolutionary aspirations for a communist utopia.[53] In 1961, soon after Gagarin's flight, Khrushchev ordered the removal of Stalin's remains from Lenin's Mausoleum in Red Square and the deletion of Stalin's name from its façade. Monuments of the Stalin era were dismantled at the same time as new memorials to the Space Age were being unveiled. As Stalin's statues—forceful and traumatic reminders of Stalinist terror—were being removed, futuristic visions of space exploration took the center stage. Escaping the Earth's gravity came to symbolize for many an escape from the Stalinist past: "For the Soviet man, space was also a symbol of total liberation. Stalin was exposed, Solzhenitsyn was published. . . . The leap into space seemed as the logical conclusion of liberation and the logical beginning of an era of freedom."[54]

Like any irrational construction, which was to be believed, rather than critically examined, the myth of the cosmonaut was full of internal contradictions. The cosmonauts were portrayed as exceptional heroes, ideal character

models for the youth. At the same time, the media stressed that they were ordinary citizens, sharing life experiences with the rest of the Soviet people. Gagarin, in particular, was portrayed as "a normal Soviet guy, and yet a cosmic superhero."[55] The first cosmonauts had military ranks but their flights were presented as entirely peaceful. They were perfectly disciplined, yet capable of taking risks. Some media reports of spaceflights stressed the cosmonauts' personal accomplishments, while others stated that those were collective, rather than individual, achievements.[56]

In July 1980, shortly before the opening of the Moscow Olympics, a monument to Gagarin was unveiled in Moscow. A giant Gagarin's statue is soaring 40 meters (130 feet) above the crowd on top of a colossal pillar, which evokes the image of a rocket plume. The cosmonaut and his rocket are symbolically fused, presenting Gagarin as a superhuman blend of a man and a machine. The insurmountable distance between the statue and the viewer emphasizes the mythological proportions of Gagarin's figure, which rises in its futuristic perfection far above today's all-too-human world.

MYTHOLOGIZING ENGINEERS

While Soviet ideologues cultivated an idealized image of the Soviet space program for propaganda purposes, space industry officials had their own reasons to avoid publicity about equipment failures and in-flight emergencies. They were concerned that negative publicity might dampen the Soviet leadership's enthusiasm for the space program. The convenient arrangement, by which the space industry itself controlled public access to information about space, helped the industry leaders exercise considerable control over Soviet public discourse about space. The industry's leading think tank, the Scientific Research Institute No. 88 (since 1966, the Central Scientific Research Institute of Machine Building), was charged with the task of clearing all space-related materials for publication in the open press.[57] Numerous equipment failures, failed launches and dockings, crew errors, and canceled projects were not mentioned publicly. The existence of entire programs—for example, the secret human lunar landing program—was passed over in silence. As a result, Soviet-era space history reproduced the same clichés: cosmonauts were flawless heroes, their missions were fully successful, and the onboard automatics always worked perfectly.

Leaders of the space industry were acutely aware of the historical significance of their projects, but their vision of history reflected a desire to improve on reality to meet an ideal. As if they were writers of Socialist Realist novels, space engineers strove to depict reality as it ought to be, rather than as it was. As Katerina Clark has noted, early Soviet discourse constantly oscillated between "what is" and "what ought to be."[58] In space engineers' view,

Figure 1.2. Gagarin monument in Moscow, unveiled in 1980. Sculptor Pavel Bondarenko. Image courtesy of Babak Fakhamzadeh.

"what is" was just a messy, error-prone draft, while the history's hall of fame deserved a clean, showcase version of "what ought to be." Korolev did not allow any journalists at the launch site on the day of Gagarin's pioneering flight on April 12, 1961.[59] Several months later, however, after the launch of Titov, Korolev sat down for a filming session, pretending to communicate with the cosmonaut in orbit. A shot from that filming session is still widely circulating as an iconic depiction of Korolev allegedly communicating with Gagarin in orbit.[60] Similarly, working meetings of the state commission that reviewed flight preparedness were conducted behind closed doors. Yet, prior to each launch, the Commission held a special ceremonial meeting, during which all chief designers gave reports, and the crew was officially announced. Korolev strongly encouraged extensive photographic and film recording of such ceremonial meetings, as well as other preflight rituals.[61] Any slips, for example, a mispronounced name of a cosmonaut, were cut out of the recordings.[62] As the identities of Korolev and other Commission members were a state secret, these recordings were not publicly released at the time. This record was produced for internal consumption—for the insiders of the space program—and for future generations as a "clean" version of historical events.

Korolev fully appreciated the symbolic meaning of space artifacts. Before the launch of *Sputnik*, two copies of the satellite were made: one for the flight and one for ground tests and simulations. For engineering reasons—to maximize reflection of solar light in order to avoid possible overheating—the surface of the flight copy had to be polished. Korolev insisted that the test copy be polished as well: "It will be displayed in museums!" He admired the aesthetic appeal of the ball-shaped *Sputnik*, telling his associates that the *Sputnik* must look "properly" as a symbol of human entry into space.[63] In 1958 a *Sputnik* replica was exhibited at the Brussels World Fair. Historian Lewis Siegelbaum's study of internal Soviet discussions suggests that the intent of the exhibit was "not so much to distort reality as to display an idealized or 'higher' version of it, in the hope that doing so would inspire people to work towards making the extraordinary become more ordinary."[64]

The media focus on the cosmonauts produced some resentment among the space engineers, and they constantly fought secrecy restrictions to gain opportunities to display their achievements publicly. Soon after Gagarin's flight, Korolev suggested displaying a mock-up of Gagarin's space capsule at an aviation show at the Tushino airfield in Moscow in July 1961. Since Gagarin's *Vostok* spacecraft was still classified, Korolev advised his subordinates to "unleash their fantasy."[65] The display included no actual spacecraft, only the upper stage of the booster rocket and the shroud covering *Vostok*. Perhaps to make the shroud look "properly," Korolev's engineers attached an annular

aerodynamic fin to the back of the mock-up. The result looked impressive but had little to do with Gagarin's actual spacecraft.[66]

Soviet media skillfully "enhanced" iconic images to stress their ideological message and to eliminate any undesired connotations. For example, the May 1961 issue of the Soviet illustrated magazine *Science and Life* featured a drawing of Gagarin's launch on its cover. The drawing faithfully depicted the actual scene of Gagarin bidding farewell to a group of government officials, military officers, engineers, and technicians, with one exception: all the military personnel at the launch pad were magically transformed into civilians, their military uniforms replaced with colorful cloaks.[67] The cosmonaut trainee Vladimir Bondarenko, whose accidental death during training was concealed from the public, was erased or cropped from cosmonaut group photos, along with other "undesirable" individuals.[68] Such manipulations with visual record drew on the rich Soviet tradition going back to the Stalin-era deletion of images of high-profile "enemies of the people."[69]

After Korolev's death in 1966, the Soviet space myth turned from the hagiography of cosmonauts to the sanctification of engineers. Korolev's name and his role in the space program were no longer a state secret. His ashes were publicly buried in the Kremlin wall, and the top Soviet leadership signed his obituary. In February 1966 the Party Central Committee and the Council of Ministers adopted a secret joint resolution, "On the Commemoration of the Memory of Academician S.P. Korolev." The document ordered the erection of three monuments (two of them in closed locations, Korolev's design bureau and Baikonur) and the installation of two memorial plaques (one of them in a closed location, at the Progress rocket plant in Kuibyshev). Korolev's name was given to the Kuibyshev Aviation Institute and to the street in Moscow where he had lived. At the last moment, the question of turning Korolev's house in Moscow into a museum was raised. The resolution did not mandate the creation of the museum but only called for further discussion of this issue.[70] The museum was established only in 1975.

While the scale of government-sponsored commemoration was fairly modest, the leadership of the Soviet space program and local officials seized the opportunity to turn Korolev into an emblem of Soviet space achievements. In April 1966, just three months after Korolev's death, an additional memorial plaque was installed at his birthplace in Zhitomir, Ukraine; the house where he spent only the first two years of his life was later turned into a museum. In 1967 Korolev's cottage on Baikonur became a museum. Monuments to Korolev subsequently sprang up in Moscow, in Zhitomir, in Kiev, on Baikonur, on Kapustin Iar launch site, and at Korolev's design bureau. The town of Kaliningrad (previously named Podlipki), where the bureau was located, was renamed Korolev, and another Korolev monument was erected on its central

square. Streets in Moscow, Kiev, Zhitomir, Kaluga, Vinnitsa, Magadan, and on Baikonur, an oceanic ship, and a mountain were named after Korolev.[71] By imprinting Korolev's name in the cultural memory of the space program, engineers were gaining their rightful place in Soviet space mythology.

A string of disasters that hit the Soviet space program after 1966 resulted in nostalgia for the glorious days of Korolev's leadership. The tragic loss of Komarov during the *Soyuz 1* mission in April 1967 and Gagarin's death during a training airplane flight in March 1968 created a sense of general disarray in the Soviet space program. The lunar landing of *Apollo 11* in July 1969 added insult to injury.[72] The Korolev era was now recalled as a "golden age" of Soviet cosmonautics.[73] Korolev's name came to stand for integrity, unbending will, uncompromising dedication to safety, and resistance to administrative pressure. His historical persona acquired a mythological stature.

As Korolev was gradually turning into a symbol, his image noticeably changed. The mythological Korolev rose above all human frailties and became a visionary. His personal enthusiasm for human spaceflight signified unchained aspiration for technological and social progress of the entire nation. Although prior to their flights most cosmonauts met with Korolev only a couple of times, their biographies invariably depicted him as their spiritual father.[74] As sites of memory shifted from photographs to monuments, the mythological Korolev farther and farther departed from his historical prototype.

Mythologization is visible in the 1975 dual monument to Korolev and Gagarin by the sculptor Oleg Komov, later installed in Taganrog. The monument is modeled after a historic 1961 photograph, but the monument subtly deviates from the original image. In the photo, Korolev and Gagarin are smiling, looking at each other, and are engaged in a lively conversation.[75] On the monument, their faces are somber; they look away from each other and are apparently engrossed in daydreaming about space exploration. Korolev no longer speaks to Gagarin; he speaks "to posterity."[76] Gagarin's image, in turn, is also mythologized. In real life he was shorter than Korolev, as the first cosmonauts had to be small to fit into a tiny spacecraft. On the monument, Gagarin's height rivals Korolev's, adding gravitas and significance to his figure.[77] Korolev and Gagarin have lost their individuality; they have become ceremonial symbols of an important national program.

The 1972 feature movie *Taming the Fire* became a staple of the Korolev mythology. For the first time, a Soviet movie showed space engineers at work and featured impressive shots of actual rocket launches at Baikonur. Lofty aspirations for exploring space nicely intertwined with a romantic story line.[78] The director Daniil Khrabrovitskii invited Korolev's deputy Boris Chertok to serve as a consultant for the film. Chertok soon learned that his role was merely to flash out technical errors, not to help reconstruct the actual story.

Figure 1.3. Monument to Korolev and Gagarin in Taganrog, unveiled in 1979. Sculptor Oleg Komov. Image courtesy of Anatolii Karpika.

Chertok's weak attempts to discuss real events and complex interpersonal relations were quickly rebuffed. "Usually I said, 'It doesn't happen like that' or 'That never happened,'" recalled Chertok. Khrabrovitskii replied that "it needed to be that way or else [the authorities] wouldn't release the film."[79] No mention was made in the movie of Korolev's imprisonment in the Gulag and his subsequent work in *sharashka*, a prison design bureau, in the 1940s.

The myth making was not entirely imposed from above. Khrabrovitskii was consciously creating a myth. He explained to Chertok that his goal was not to show history as it happened, but as it ought to have happened: "I am not at all obliged to reverently adhere to the real characters and biographies. The heroes of the film are mine, not yours, and the moviegoers will believe me because they will love these heroes. I deliberately idealize people and I want them to be that way. These shouldn't be varnished ideals, but the viewer should love each of my heroes. Our film has no evildoers, traitors, executioners, prostitutes, or spies. I admire all of you just as you are, but I want to make you even better." Khrabrovitskii made Andrei Bashkirtsev and Evgenii Ognev—the characters portraying Korolev and the chief rocket engine designer Valentin Glushko in the film—close friends, without giving a hint of

the actual feud between the two chief designers. "It is impossible for envy to exist between real friends Bashkirtsev and Ognev. They are genetically stripped of this feeling," explained Khrabrovitskii.[80] He argued that the viewers must see the protagonists as sensitive, sympathetic, highly cultured individuals, not as cold technocrats.

Gradually Chertok learned the rules of the game and even made a valuable suggestion to introduce a new character to portray the Party leader Dmitrii Ustinov, who supervised the space industry. This turned out to be an excellent move, as Ustinov's support proved crucial in overcoming censorship barriers. Ustinov arranged a screening for Politburo members and secured their approval to release the movie.[81]

Taming the Fire was a great artistic success, but many who knew Korolev were disappointed by the lack of depth in portraying his life and character. The leading space journalist and Korolev biographer Iaroslav Golovanov wrote in his diary: "The prototypes are real, but few movies are as saturated with pretty lies as *Taming the Fire*."[82] Official Soviet critics did not find any fault in myth making. On the contrary, they touted the movie as an excellent illustration of the Socialist Realist analytical concept of "artistic truth."[83]

Just as its director intended, *Taming the Fire* became a pivotal myth of Soviet space history for generations of viewers. In 1972, when the movie was released, it was seen by 27.6 million viewers, and the popular Soviet movie magazine readers named the actor Kirill Lavrov, who played Bashkirtsev, the best actor of the year. Since then, Soviet and then Russian TV regularly showed *Taming the Fire* every year on April 12, Cosmonautics Day. In cultural memory, the romanticized Bashkirtsev took the place of Korolev. When remembering Korolev, one recalled Bashkirtsev.

The heroic myth of the Soviet space program was written in stone—in massive monuments that placed the cosmonauts, the leading engineers, and Soviet political leaders on a pedestal of historical myth. In a revealing symbolic gesture, space industry leadership placed space documents and artifacts in the foundation of an actual monument, "To the Conquerors of Space," unveiled in Moscow in 1964. A recently declassified petition from a group of industry leaders to the Soviet political leadership read:

> For the commemoration of the outstanding historical achievements of the Soviet people in the conquest of space and for the eternal preservation of documentation and other materials about the flights of Soviet spacecraft, it would be advisable to place in special sealed containers documents, films, and mock-ups of Soviet artificial satellites of the Earth, of space stations, of spaceships, and of the most important research equipment used in flight, and to brick up these containers into the

> foundation of the monument that has been erected in Moscow to commemorate the outstanding achievements of the Soviet people in the conquest of space.[84]

An identical set of carefully selected documents and artifacts was put on display in the museum built underneath the monument. Space history was written once and for all. The master narrative was protected from challenge by a stone wall. Yet this master narrative was no monolith: different agents composed different parts of it for their own purposes, inner tensions strained it, and the counter-memories cultivated by space program participants constantly eroded it.

COUNTER-MEMORIES OF THE SOVIET SPACE PROGRAM

Individual memories that did not fit into the master narrative continued to circulate informally beneath the glossy surface of official history. Myriad private stories formed an oral tradition totally separate from written accounts. Historians have traditionally associated such counter-memories "in the very shadow of the official history" with groups that are "excluded or overlooked."[85] In the Soviet space program, by contrast, the space engineers and the cosmonauts who cultivated such counter-memories were already the focus of official history. It was due to their privileged position that they had access to information concealed from an average Soviet citizen. The "true stories" of historical events that were concealed or embellished in official accounts became an essential part of their group culture. Shared private memories fostered their sense of professional identity as cosmonauts or engineers, while their public persona had to conform to the master narrative.[86]

Counter-memories often remained in the private realm not because of overt editorial pressure but because of self-censorship. For example, when asked by a TASS correspondent about his impressions of Gagarin, the prominent spacecraft designer Mikhail Tikhonravov replied:

> I first met Gagarin during exams, not knowing yet that he would be the first [cosmonaut]. He was taking a physics test, and I gave him a B, because he did not know velocity addition. He messed it up; he did not add velocities right. Then someone told me, "This is our best, most promising candidate. Is there any way he could get an A? Test him again. If he answers well, give him an A." So I had to test him again. The second time around he answered everything well, and I gave him an A.

When going over the transcript before publication, Tikhonravov made a note on the margins: "I told this just for you. This should not be published."[87] This

memory could circulate only privately, without rising to the surface of public discourse.

The engineers and the cosmonauts resented the obvious gap between their private memories and the official story. Forced to toe the official line in public, they let off their frustration in diaries and private conversations. "Why are we telling lies?" Chertok once jotted in his notebook, reflecting on multiple launch failures concealed from the public.[88] The cosmonauts were also frustrated by the need to tell "truth-lies," twisting their stories to omit failures and to comply with the official version of events.[89] Yet both the engineers and the cosmonauts learned to bend the truth with great precision and skill. Although ideological constraints and censorship were definitely imposed on the space community, the prescribed stereotypes also opened opportunities for the engineers and the cosmonauts' own self-fashioning. The engineers spruced up the reports they submitted to the leadership; the cosmonauts enjoyed their celebrity status as flawless heroes.

Space journalists, whose daytime job was to propagate official discourse, at the same time privately complained about censorship. "All our reports are half-truths, which is worse than a lie," Golovanov wrote in his diary.[90] While the rest of the world was watching a live report of the *Apollo 8* mission, Soviet television broadcasted a children's movie. "Are Central Committee officials so thick," Golovanov wondered on that occasion, "that they don't understand how foolish and shameful this is?"[91] When the publication of his article on *Apollo 11* was put on hold, he again let off steam in his private notebook: "I am tormented with shame. Will they allow such a disgrace again?"[92]

The same people—journalists, cosmonauts, and leading engineers—both wrote official accounts and shared private counter-memories. A discursive split went right through their souls. Kamanin's diary revealed his constant oscillation between the public and private modes of expression. For example, in December 1968, he wrote an article for *Red Star*, the Soviet Armed Forces newspaper, about the forthcoming launch of *Apollo 8*. Kamanin had to mitigate the news of the conspicuous American success in the lunar program. He titled his article "Unjustified Risk" and harshly condemned American politicians for endangering the lives of astronauts in a mission that could easily be performed by automata. Naturally, he did not even mention that the Soviet Union had its own secret human lunar program. But in his diary he frankly admitted that the Americans were getting ahead in the lunar race and railed against the Soviet officials whom he saw as the true culprits: Party leadership, military brass, and top administrators of the space program who neglected or misdirected the program for far too long. "They have neither time, nor knowledge for the management of space exploration," he wrote in the diary. "The in-

dustry is often late in fulfilling production plans; they build spaceships hastily and with poor quality, and because of that, the launches are often delayed."[93]

In his diary Kamanin condemned the very practices he enforced at his day job. Publicly, Kamanin served as an editor and informal censor of popular publications about space. When Tereshkova complained to Kamanin that her ghost-written autobiography contained numerous embellishments, which had no roots in real events, Kamanin acknowledged that the journalistic account followed stereotypes and had many discrepancies, but it was too late to make any corrections if the book was to be released by the third anniversary of Gagarin's flight. Privately, he deplored the platitudes in literature about cosmonauts, remarking that "the most interesting things in our cosmonautics are classified." He lamented the official ban on reports about equipment failures and flight emergencies, which he himself had to enforce: "Because of these restrictions, we are actually robbing ourselves by creating an impression of 'extraordinary ease' and almost complete safety of prolonged spaceflights. In fact, such flights are very difficult and dangerous for the cosmonauts, not only physically, but also psychologically." Kamanin realized that the erasure of accidents from cultural memory gave rise to myths that created a fundamental misimpression of the space enterprise. Yet Kamanin himself discouraged more controversial public representations of human space exploration. For example, he refused to serve as a consultant for Andrei Tarkovsky's movie *Solaris*, because, as he explained, such fiction "belittles human dignity and denigrates the prospects of civilization."[94]

Although such sentiments did not translate into an active opposition to the Soviet regime, they indicated a form of defiance among the very groups that were supposed to be the backbone of the Soviet state—the military and the defense industry workers. Space engineers cultivated their own countermemories. Weary of the constant disruptions from Khrushchev's numerous reorganizations of economic management structures, the engineers began recalling fondly the "iron discipline" of the Stalin era as a sound foundation for powerful industrial development.[95]

Exchanging their private memories of the Stalin period, the engineers produced the myth of a "golden age" of Soviet rocketry. In fact, in the late 1940s, top defense industry managers similarly complained of insufficient resources and inadequate management.[96] Yet the counter-memory of the Stalin era as the epitome of strong management, strict discipline, and personal responsibility became part and parcel of the professional culture of Soviet rocketry.

The cosmonauts, whose private lives were controlled by their military superiors almost as strictly as their public image, had little room to cultivate their private memories. Yet they treasured precisely those moments of their lives that were untouched by publicity. When Yuri Gagarin wanted to give his

mother his framed photograph, he did not choose any of the iconic images endlessly reproduced around the world but asked for a copy of the photo that had been taken during an accidental encounter in 1960, before Gagarin performed his spaceflight and became a world celebrity.[97]

While the cosmonauts and the space engineers privately cultivated their counter-memories, alternative representations of the space age began to emerge on the margins of public discourse—rumors, jokes, and readers' letters to newspapers and magazines. With the decline of the cosmonaut myth in the late 1960s, the triumphal tone of official reports, which had not changed since the time of Gagarin's flight, began to sound pathetic. The deaths of Komarov and Gagarin led to widespread cynicism toward official reports. The public widely distrusted the vague official statement on the causes of the crash of Gagarin's plane; wild rumors of Gagarin's alleged drunkenness, pilot error, or an assassination by the KGB were often deemed more credible.[98]

The public also grumbled about the immense expenses of the space program and the costs of cosmonauts' publicity tours. These topics were not publicly discussed, only occasionally surfacing in readers' letters or private conversations. For example, in June 1960, a youth newspaper published a letter from one Alexei N., who bluntly asked about the space program, "What's in it for me?" "I, for example, on the eve of the launch of a rocket, received 300 rubles salary, and this is what I still receive, in spite of the successful launch. Doesn't it seem to you that the enthusiasm for these sputniks and the cosmos in general is inopportune and, more precisely, premature?" he asked. "Rocket, rocket, rocket—what's it needed for now? To hell with it now, and with the moon, but give me something better for my table. After that, then it will really be possible to flirt with the moon."[99] A 1963 secret KGB report quoted the retired Marshal Georgii Zhukov saying, "They throw billions into space. Yuri Gagarin's flight cost nearly four billion rubles. No one ever asked about the cost of all these receptions, all these trips, guest visits, etc."[100] As foods and goods shortages plagued the economy, the public increasingly questioned the lavish funding of the space program.

After the 1969 lunar landing of *Apollo 11*, the Soviet lag in space became painfully obvious. The public now greeted official reports of Soviet triumphs in space not merely with skepticism but with ridicule. One joke was about Brezhnev instructing cosmonauts:

> Brezhnev invites a group of cosmonauts.
>
> —Comrades! The Americans have landed on the Moon. We have conferred and decided that you would fly to the Sun!
>
> —But we'd burn down there, Leonid Il'ich!
>
> —Don't worry! The Party has thought it all through. You will fly at night![101]

A later version added a twist: the cosmonauts replied, "And how would we find it at night?" The mockery was thus aimed not just at the Soviet politicians but also at the cosmonauts.

The Jewish emigration in the 1970s added to the wave of cosmonaut jokes: "Armenian Radio asked the question: Why is it that the Soviet Union is not sending cosmonauts to the Moon? Answer: There is a fear that they will emigrate."[102] Another joke mocked the cheerful tone of cosmonauts' reports from the orbit: "Rabinovich is launched into space. He sends a message, 'At the distance of 10,000 kilometers from the Soviet Motherland, I am feeling particularly well.'"

The Communist Party and the Soviet state actively encouraged the creation and dissemination of space myths, but these myths were not entirely imposed from above. Different agents—military officials, engineers, cosmonauts, writers, movie directors, and many others—actively participated in reshaping the myths to suit their own agendas. Often the same people, the insiders of the space program, were involved in creating both official versions and counter-myths, drawing on their private memories. Both types of myth were addressed to specific audiences—whether the public or a narrow professional circle—and embodied specific political and cultural values. Both types of myth played a constructive role. The public myths greased the wheels of the propaganda machine, gave tangible representations to the ideological concepts of socialism and nationalism, and cemented the identity of a nation. The counter-myths, for their part, reinforced the professional identity of cosmonauts and space engineers, and created an outlet for the frustrations and complaints purged from the official discourse. Rocket engineers, in particular, drew their professional identity from the foundational myths told about the origins of the program in the trials by fire of the Stalin era.

2 STALIN'S ROCKET DESIGNERS' LEAP INTO SPACE

The Technical Intelligentsia Faces the Thaw

ON September 25, 1938, Joseph Stalin authorized execution by firing squad of seventy-four military specialists and defense engineers. The rest of the Politburo followed suit, huddling their signatures below Stalin's. This was a routine procedure; in 1937–1938, Stalin signed over 350 such lists, condemning to death at least 39,000 people whose execution required his personal sanction. Number 29 on the September 25 list was an engineer from a rocket research institute, one Sergei Korolev. He had been arrested in June 1938 on a trumped-up charge of wrecking and sabotage and tortured into confession.[1] Two days after Stalin's approval, a quick trial hearing was held. Fifty-nine people on the list were sentenced to death and immediately executed. Korolev was lucky: after retracting his confession, he received a ten-year sentence. Another engineer from the same institute, Valentin Glushko, had been arrested three months before Korolev on the same charge and also sentenced to prison time. Glushko was sent to work at a *sharashka*. Korolev served the first several months at the notorious Kolyma labor camp, barely survived, and eventually ended up in the same *sharashka* as Glushko. Both were released only in 1944, after successfully completing the design of a new airplane, but the charges against them were not formally dismissed for another ten years.[2]

The names of Korolev and Glushko are now associated with some of the most remarkable technological achievements of the twentieth century. Korolev, the chief designer of rocket technology, and Glushko, the chief de-

signer of rocket engines, played a crucial role in the development of Soviet rocketry, building the first Soviet intercontinental ballistic missile, launching *Sputnik*, and sending the first man into space.[3]

Many other rocket engineers were also adversely affected by the Stalinist oppressive policies. Boris Raushenbakh, a leading control systems engineer, was interned in a labor camp as an ethnic German during World War II.[4] Another leading rocket designer, Mikhail Iangel', lost his brother in the Gulag, and barely escaped an arrest himself.[5]

Nevertheless, the Stalin era has been held up as the Golden Age of rocketry in the historical mythology that permeates the Russian space program. Veterans of the rocket and space industry often recall the postwar years as a time of optimism and enthusiasm, which created a "romantic drive."[6] How did the Stalin period, in which so many future prominent spacecraft designers suffered persecution and worked under constant surveillance and threat, suddenly acquire the mythological status of a Golden Age? To answer this question, this chapter traces the deep connections between the Stalin and Khrushchev periods in the development of rocketry. The quasi-nostalgic image of the Stalin era as an embodiment of the ideals of discipline, responsibility, and wise management appears as a collective memory construct, developed by space engineers in frustration over their later experience with the increasingly chaotic organization of the Soviet space industry.

The Soviet space program achieved its greatest successes—*Sputnik*, the first man in space, the first group flight, the first woman's flight, the first multicrew mission—during the Khrushchev era. This was a tumultuous period that combined many contradictory trends. Khrushchev's "secret speech" at the Twentieth Congress of the Communist Party condemned Stalin's "cult of personality" and opened the gates for de-Stalinization in wider society. On the contrary, the violent Soviet suppression of the Hungarian uprising, the vociferous campaign against the Nobel Laureate poet Boris Pasternak, and Khrushchev's public outbursts against liberal intellectuals testified not only to Khrushchev's oscillating personality but also to the uncertainty and instability that characterized this period's politics and culture. As historian Polly Jones has noted, "Characteristic of the Khrushchev period were repeated swings in official policy, as the new leadership attempted to maintain a tense balance between enthusiasm for discarding the past, and uncontrolled iconoclasm, between mobilizing the energy of 'new forces,' and giving in to anarchy, between maintaining the Soviet system, and causing its implosion."[7]

Among the confusion and contradictions of the Khrushchev era, the tremendous Soviet technological leap into space had a very specific symbolic meaning. In the public mind, it represented a daring breakthrough into the future—both into the technological utopia of interplanetary travel and

into the political utopia of communism. According to a 1963 poll by a popular youth-oriented Soviet newspaper *Komsomol'skaia pravda*, *Sputnik* was viewed as the greatest technological feat of the century.[8] In this sense, space exploration epitomized the Thaw as a movement beyond Stalinism into a new and exciting political and cultural territory.

In this chapter I focus on two mutually shaping processes: the development of the space industry and the formation of identity and professional culture of space engineers as a specific group of the Soviet technical intelligentsia in the late 1950s and 1960s.

Historian Kendall Bailes argued that the prewar Soviet "technostructure," or engineering elite, did not simply followed orders issued by the "power structure," or political authorities. On the contrary, the technical intelligentsia played an active role in reshaping the Soviet social and cultural landscape.[9] Walter McDougall noted a similar trend in the postwar period. In his study of the U.S. and Soviet space programs, he emphasized the growing political influence of the technocratic elites during the Cold War on both sides of the Iron Curtain.[10] In the 1990s several important studies of the inner bureaucratic workings of the Soviet space program revealed a complex picture, in which different groups of space engineers competed for space projects and had to negotiate with multiple power brokers in the Party and government apparatus, in the military, and in the defense industry.[11]

Focusing on the role of professional culture of rocket and space engineering, this chapter draws on recent studies of patronage, networking, and professional norms in Soviet society.[12] These studies have stressed the central role of personal networks in strengthening the Soviet state and at the same time helping individuals overcome bureaucratic bottlenecks. Sheila Fitzpatrick has argued that in Stalinist society "outward conformity to ideology and ritual mattered, but personal ties mattered even more."[13] "Born of inefficiency and encouraged by the Party's longstanding, self-proclaimed right to intervene to correct any bureaucratic shortcoming, unofficial networks permeated the bureaucratic system," writes Kiril Tomoff.[14] Jerry Hough and Gerald Easter have explored how cohesive groups of Soviet functionaries with close personal ties established and maintained the effectiveness and stability of the Soviet state.[15] Barbara Walker has suggested that "the Soviets were able to create such an inefficient means of redistribution . . . precisely because effective prior networking and patronage relations mitigated and obscured the profound inadequacy of the bureaucratic system as it took shape."[16]

Professional networks played a particularly important role. Belonging to a professional network not only shaped the identity of engineers, scientists, and managers, but also allowed them to consolidate their efforts in furthering their professional agenda. For example, according to Mark Adams, by us-

ing personal networks, the scientific community during the Khrushchev era proved "more resourceful at manipulating [the Soviet] system to serve its own agendas than even the most optimistic advocate of academic freedom might have hoped."[17]

These studies overturn the stereotypical picture of the Soviet citizen as either blindly supporting or passively resisting specific government policies. This perspective illuminates the complex dynamic of the technical intelligentsia's service to the state: the engineers constantly grappled with the inconsistencies and uncertainties of the political and administrative environment and tried to formulate their own technocratic agenda, while negotiating and reinterpreting government policies. Instead of positing an opposition between the technical intelligentsia and the state, it would be more productive to talk about the inner tensions that defined the intelligentsia's identity and about its involvement in the formulation and implementation of government policies through both official and unofficial means.

ORGANIZATIONAL PROBLEMS OF THE ROCKET AND SPACE INDUSTRY

The date of May 13, 1946, when Stalin signed a decree establishing a Special Committee for Reactive Technology, is still celebrated today as the birthday of the Russian rocket and space industry. The Committee was headed by Stalin's chief lieutenant Georgii Malenkov and included several leading defense industry managers. The missile program was organized on the same principles as the atomic project, managed by the Special Committee No. 1: a crash program with direct political support from the top, vast funding, and enormous resources. Key institutions of rocketry development were created, including the Scientific Research Institute No. 88, which initially included Korolev's design bureau.[18]

The story of Stalin's critical personal involvement in the launching of the Soviet rocket industry has been told many times and acquired truly mythic proportions. Some of it was clearly based on hearsay and was not confirmed by documentary record.[19] Yet in the identity-shaping folklore of Soviet rocket designers, the truly significant support that the Soviet government gave to the highest priority missile program in the late Stalinist period is often personified in the figure of Stalin as a great benefactor of Soviet rocketry. After Stalin's death in March 1953, Korolev—clearly unaware that Stalin had nearly condemned him to death—expressed genuine sorrow in a private letter to his wife: "Our Comrade Stalin passed away. . . . My heart hurts so much, my throat is clogged, and there are no thoughts and no words to express the tragedy that befell all of us. This is truly a national, immeasurable tragedy—our beloved Comrade Stalin is no more."[20]

The launch of *Sputnik* in October 1957 on top of the R-7 intercontinental

ballistic missile, designed by Korolev, became a highly visible sign of success of the missile program supervised by the Special Committee for Reactive Technology. The successful completion of the three major defense industry projects of late Stalinism—the nuclear weapons, the ballistic missile, and the radar—engendered a radical reorganization of the defense complex. Coupled with Khrushchev's far-reaching reform of the national system of economic management, this led to the complete dismantling of the old Stalinist system of defense industry management. In December 1957, the three special committees supervising the nuclear weapons, the ballistic missile, and the radar programs were abolished, and instead a new agency was created—the Commission on Military-Industrial Issues under the USSR Council of Ministers—to coordinate the work of the defense industry ministries.[21] Another reform threatened the ministries themselves. The same year, Khrushchev proposed a radical management reform of the national economy, replacing the system of central ministries with a system of regional economic councils. Instead of a single ministry controlling all enterprises in a particular branch of industry across the entire Soviet Union, a regional economic council would supervise all the industries located on its territory. This literally threw the economy into chaos.[22]

The defense industry was not immune to the general economic disarray. A group of top managers wrote a letter to Khrushchev, persuading him to exempt the defense industry from the management reform, but they failed.[23] Among others, missile-producing plants and factories were transferred under the control of their regional councils. When Khrushchev famously claimed that "we are producing missiles like sausage," he was indeed correct. The production of missiles was plagued by many of the same problems as the production of sausage: broken supply chains across regional borders, poor coordination between central and regional agencies, and overlapping and conflicting spheres of authority of multiple supervising bodies.

The nascent space program had a particularly difficult time adapting to the new administrative regime. In the Soviet Union, there was no single central agency like NASA solely responsible for the funding and supervision of the space activities. Space projects were officially authorized by joint resolutions of the Party Central Committee and the Council of Ministers, but these decisions often came with no financial backing. In 1959 Korolev's bureau received no funding for the development of the *Vostok* spacecraft and for the rockets it used to launch automatic lunar probes. By early 1960, the bureau ran a deficit of 95 million rubles; by the end of February it exhausted all the funds allocated for the first quarter, and by March 1960 it had no cash at all. Korolev constantly petitioned his superiors asking them for the 95 million rubles that the bureau had already spent fulfilling Party and government resolutions. Af-

ter a month of bureaucratic wrangling, Korolev received a 50 million grant and a 22 million loan, still far short of his needs.[24]

After Gagarin's successful orbital flight on board the *Vostok* in April 1961, euphoric Khrushchev showered the space industry with medals and awards, and he became much more receptive to more ambitious plans of space travel to the Moon, Mars, and beyond. The new larger projects, however, faced even greater organizational and financial problems than the *Vostok* program. The growing complexity of rocket and spacecraft design and production required cooperation and coordination on an unprecedented scale. Korolev's Special Design Bureau No. 1, which served as the rocket and space technology integrator, had to deal with hundreds of subcontractors. As a deputy chairman of the Military-Industrial Commission recalled, any broken deadline could lead to the "total disorganization of the entire project."[25] Because the space program developed on the basis of ad hoc decisions of the Party and the government, space projects often were not included in long-term economic planning. Their implementation required multiple adjustments of production plans for hundreds of enterprises across the Soviet Union. The cumbersome system of central planning had great difficulty managing such fast-paced large-scale technological projects.

In July 1963, in an attempt to bring some order into the increasingly chaotic network of supply chains, the Council of Ministers established a system of monetary sanctions for undisciplined suppliers who did not fulfill their assignments on time. The reasons for delays were often referred further and further down the supply chain, which made it nearly impossible to find and punish the "real" culprit. For example, in November 1965 a factory in Sverdlovsk was threatened with hefty fines for its failure to deliver a batch of launchers and missiles to the Ministry of Defense on time. By arguing that the delay in production was caused by subcontractors, the factory officials were able to obtain an exemption from the sanctions.[26]

The Soviet lunar program was besieged by inadequate funding and huge organizational problems. A rift between Korolev and Glushko resulted in the latter's refusal to build engines for the former's N1 lunar rocket and forced Korolev to collaborate with an engine contractor from another ministry. In the meantime, other leading missile designers, such as Vladimir Chelomei and Mikhail Iangel', actively promoted competing proposals for lunar missions. Korolev and his rivals cleverly used their political patronage ties with the top echelon of the Soviet government and lobbied for their own versions of government decrees. The ensuing compromise split the lunar program—including all the funds and resources—between Chelomei and Korolev. One built a rocket and a spacecraft for a circumlunar flight; the other designed another rocket and another spacecraft for lunar landing. This resulted in an

unprecedented duplication of effort in the design and production.[27] The acute shortage of funds forced Korolev to cancel the construction of a ground testing facility for the entire cluster of first stage engines for the N1 rocket. This proved to be a fatal decision, which spelled the ultimate failure of the entire program.[28]

The troubles with the organization of the rocket and space industry continued after Khrushchev's ouster from power in October 1964. The following year the Soviet government abolished the regional economic councils and restored the system of industrial branch ministries. The newly created Ministry of General Machine Building gathered under one administrative umbrella most of the bureaus and factories involved in rocket and space design and production. Korolev tried to seize this moment to transfer to the Ministry as many of his subcontractors as possible. For example, in October 1965, he attempted to acquire control over the Balashikha plant that worked on a fueling system for the N1 rocket. He complained that the plant's performance was "exceptionally poor": with less than a year left before the deadline, the plant completed only 1 percent of the total amount of work. Korolev lost this round of bureaucratic power play: the plant was transferred to another ministry.[29]

The problem of component supply was not solved by the restoration of the ministry system; in a certain way, it became even more complicated. Every contract between two organizations from different ministries now had to be approved by both ministries. Trying to reduce their overall load, various ministries often refused contracts for complex rocket and space equipment. For example, in February 1966 the Ministry of Electronic Industry flatly rejected a request to start production of ground control equipment for missiles and spacecraft. The head of the Ministry declared that the proposal was "totally unrealistic and obviously impractical."[30] In August 1966, the Ministry of Heavy Machinery refused to produce girders and support constructions for the N1 assembly, even though it had been assigned this task by the Party Central Committee, the Council of Ministers, and the Military-Industrial Commission.[31] "Having different ministries is like having different governments," one contemporary observed.[32]

In such circumstances, it was hardly surprising that the leaders of the rocket and space industry looked back at the Stalin years with a bit of nostalgia. In the folklore of Soviet rocketry, in the foundational myths that laid the narrative basis for rocket engineers' professional culture, even the fear and oppression of the Stalin era were often remembered fondly as productive mechanisms for instilling a strong sense of personal responsibility. For example, Iurii Mozzhorin, director of the Scientific Research Institute No. 88, wrote: "At that time, Joseph Stalin, who did not forgive any mistakes, was still in power, and our branch of industry was supervised by Lavrentii Beria, his

henchman. For this reason, the development of technical-tactical specifications for rocket weaponry and its deployment had extraordinary significance and required a responsible approach."[33] Mozzhorin meaningfully pointed out that in the Stalin years no institutions, organizations, or individuals had been allowed to interfere with rocket research and production without special authorization from the Council of Ministers.[34]

Soviet rocket engineers' fond memories about Stalinism as the Golden Age of rocketry were quite selective. Beria did not directly supervise Soviet rocketry (he was responsible for the atomic bomb), but his prominent presence in rocket engineers' folklore is indicative of their mythology of Stalinism. The perfect order and discipline of the Stalin era were a useful construct that helped underscore the engineers' critique of the haphazard management of the space program under Khrushchev. In fact, in the late 1940s top defense industry managers similarly complained of insufficient resources and petitioned to transfer factories from other ministries to their own control to ensure timely supplies.[35] Recent studies show the utter inefficiency of Stalin-era coercive measures and severe punitive regime at industrial enterprises.[36] Yet the image of the Stalin era as the epitome of strong management, strict discipline, and personal responsibility formed the foundation for the professional culture of Soviet rocketry.

The nostalgic mood among the rocket engineers reflected broader sentiment awakened in Soviet society by the contradictory policies of de-Stalinization. The wave of crime that followed the return of Gulag prisoners brought widespread anxiety and prompted calls for harsh law-and-order methods reminiscent of the Stalin era.[37] The generation that came to the fore during Khrushchev's Thaw—a young cohort of rocket and space designers—was, in fact, Stalin's "last generation," the generation of postwar youth. They did not live through the horrors of prewar terror and learned instead the useful life strategies of "circumvention, avoidance, and sidestepping."[38] As a living bridge between the Stalin and Khrushchev periods, they embodied historical continuity.[39] As Juliane Fürst has noted, "They were believers in as far as few challenged the foundation of the Soviet state, yet they were also cynics who played the system skillfully and to such an extent that the ritual of playing sustained the system rather than faith in its veracity."[40]

To pull the Soviet space enterprise out of the chaos of Khrushchev's organization of industry, the leaders of the space program began to play the system, using some of the tried-and-true strategies of the Stalin era.

PLAYING THE SYSTEM

In May 1964, frustrated by the lack of action on the government resolutions authorizing the lunar program, Korolev decided to appeal to Leonid

FIGURE 2.1. Sergei Korolev's office memorial at the Energia Rocket and Space Corporation Museum, town of Korolev, 2004. Photo by author.

Brezhnev, then the secretary of the Central Committee for defense industry. "There is no firm deadline, or essential organization, or sufficient financial or material support," he wrote. "The initial sum of money set aside in 1964 for the Ministry of Defense to build pre-flight testing and launch facilities for the N1, was 11 million rubles, but then Ministry suddenly reduced this amount to 7 million, most recently to 4 million, and currently the Ministry refused any further financing of the N1 construction despite the existing Party and government resolution to this effect."[41] Korolev did not send the letter, perhaps realizing the futility of the effort. The customer—the Ministry of Defense—did not provide funds, subcontractors avoided contracts: Korolev was caught in the middle of a stalled economic and administrative structure.

The overly complicated system of Soviet defense industry management, which was supervised by several Party and government agencies with overlapping authority and conflicting interests, relied on the Military-Industrial Commission to coordinate projects across agency lines. The Commission, with its limited authority, could hardly manage large and complex space projects, and Korolev regularly complained about its poor performance. He suggested that the industry should be reorganized along the same lines as the Stalin-era nuclear weapons and air defense programs, that is, controlled by a single cen-

tral agency.[42] Unable to effect such a radical administrative reform, he decided to facilitate government decision making and enforce the discipline of supply and production by other means. Korolev established an alternative management mechanism, which complemented government structures and helped overcome bureaucratic barriers. He borrowed some of the proven management techniques of the Stalin era and adapted them for the new environment.

First, Korolev vastly expanded and strengthened his personal network. Like all chief designers, he attached special importance to the "vertical" patronage ties with Khrushchev and the chief patron of the defense industry Ustinov. But his most effective tool was a "horizontal" network, linking together top engineers and defense industry and military leaders. The hub of this network was the Council of Chief Designers. Korolev organized this informal body in 1947 to coordinate the efforts of several key institutions involved in the design of the first Soviet ballistic missiles. The six original members of the Council were Sergei Korolev (the entire rocket complex), Valentin Glushko (rocket engines), Mikhail Riazanskii (ground-based guidance systems), Nikolai Piliugin (onboard guidance systems), Viktor Kuznetsov (the chief designer of gyroscopes), and Vladimir Barmin (launch equipment). The original six were bound together by the ties of personal acquaintance and friendship going back to the 1930s early rocketry studies or to the 1940s prolonged joint mission to occupied Germany to collect rocketry artifacts and know-how.[43] The Council tackled 90 percent of all engineering problems.[44]

While working on *Sputnik*, the first lunar probes, and the first piloted spacecraft, Korolev realized that a whole host of new problems arose—both technical and administrative—that went far beyond the area of expertise and influence of the original "rocketry caste." He invited at least fifteen new members, including leading mathematicians, ballistics specialists, designers of communications systems, new engine designers, ground tracking specialists, physicians, and Air Force officials.[45] The sphere of the Council's authority expanded from pure engineering to organizational issues. Achieving a consensus among the chief designers was crucially important not only for resolving internal disputes but also for presenting a joint front to lobby the higher authorities.

Members of the Council played a unique role: through personal contacts and alliances with multiple power structures within the Party and government apparatus, they lobbied for their projects, obtained official approval, and were able to enforce the execution of government orders, which government officials often failed to do. As Korolev's first deputy Vasilii Mishin aptly put it, "Korolev was built into the space program like an engine into a rocket. He fitted into the existing social and economic system so well that he could in fact circumvent it."[46] The leading spacecraft designer Konstantin Feoktistov con-

firmed that "strategic decisions were made not by the Party Central Committee or by the government, but by Ustinov and Korolev, and often by Korolev alone. Only later, one way or another, they managed to obtain an official endorsement of those decisions by the 'competent organs.'"[47]

Instead of hierarchical top-to-bottom decision making, the Council practiced consensus-building negotiations. If the chief designers could not reach a decision on a complex issue, the Council created a working group to hammer out a compromise. As an engineer from Korolev's firm recalled, Korolev's working style was to "arbitrate disputes."[48] Yet he was not willing to postpone decisions indefinitely; if the Council could not eventually reach a consensus, Korolev would make a decision himself.[49]

In the 1960s, the Council of Chief Designers—an informal body, whose decisions had no legal binding power—became a de facto steering committee for the Soviet missile and space program. The Council often invited to its sessions a large group of defense industry managers, military officials, and academics. At those informal meetings, Korolev and other chief designers could frankly exchange opinions on crucial technical and organizational issues without generating a huge bureaucratic paper trail. For example, in September 1960, the Council meeting included eighty-seven participants and discussed the design of the N1 heavy booster and its potential military applications. In January 1961, the Council met again to discuss specifically the choice of fuel for the N1, taking into account the efficiency, toxicity, and cost of various fuels. The June 1964 meeting made a crucial decision to designate liquid oxygen as the main fuel for the N1, and to choose the N1 as the booster rocket for the lunar landing program.[50] This decision was made official by the August 1964 joint decree of the Party Central Committee and the Soviet Government, authorizing the Soviet lunar landing program.[51] The deterioration of Korolev's personal network after his death in early 1966 is often pointed out as a key factor in the Soviets' ultimate loss in the lunar race.

Another Stalin-era mechanism, adapted by Korolev for the 1960s, was personal responsibility of chief designers for the failure-free operation of their systems. In September 1960, as the *Vostok* spacecraft for the first human flight was being built, Korolev's design bureau prepared *Basic Guidelines for the Development and Preparation of the Object 3KA* (3KA was the code name for *Vostok*). All members of the Council of Chief Designers later signed this document. They realized that the reliability of *Vostok* was of paramount importance, but the scale and complexity of the project made efficient quality control exceedingly difficult. The total of 123 organizations from various ministries and agencies, including 36 factories subordinated to 13 different regional economic councils, participated in the construction of the *Vostok* rocket and spacecraft. The rocket engines had 33 chambers, and the spacecraft

carried on board 241 vacuum tubes, over 600 transistors, 56 electric motors, nearly 800 relays and switches connected by 880 electric plugs and almost 15 kilometers (9 miles) of cables.[52] The *Guidelines* established "personal responsibility of chief designers, factory directors, and heads of services for the quality of technical documentation, for the correctness of design, for the testing and reliability of construction elements, and for the quality of production, assembly, and testing."[53] Korolev believed that to ensure the reliability of the entire system, one had to instill the sense of responsibility not only in the top management but also in every worker involved in the production of *Vostok*. Every step in the assembly and testing was documented, including the names of the workers responsible for that step. Quality control at major stages of assembly and testing was assigned to military specialists from the Ministry of Defense. All *Vostok* parts were labeled with a special mark and documented as "suitable for 3KA." Every worker knew that the life of a cosmonaut depended on the quality of each part.[54] It is worth stressing that the *Guidelines* were not imposed on the industry by any official authority. This document was spread around and enforced through the informal network coordinated by the Council of Chief Designers.

For chief designers, greater personal responsibility meant greater personal authority. Korolev "quite consciously sought such authority," remarked an engineer from his design bureau, Georgii Vetrov. "Such authority brought him power, which Chief Designer needed as much as a military commander."[55] Other memoirists also compared Korolev to a military commander[56] or even to "an absolute dictator."[57] "The huge burden of personal responsibility, which Korolev could not share with any of his subordinates, sometimes made him exigent to the point of despotism, authoritative to the point of arrogance, and intensely focused to the point of alienation and seclusion," recalled Vetrov.[58] Korolev's idea of efficient management was to exercise personal control over every technical and organizational aspect of the space program. "As a leader, he believed he must extend his power over every single element of design," wrote Vetrov.[59] Korolev demanded, for example, "the right of the first information" about any failure during the testing phase.[60]

Korolev often began designing and even building rockets and spacecraft on his own initiative, without any official contract, using only the internal resources of his design bureau. This strategy of "design with anticipation" required "a tough character and strong nerves," for it relied on the unquestionable belief in the ultimate success of the pending proposal.[61] This risky strategy paid off when Korolev faced a rival: he used to shore up his proposals with a hardware prototype that, however imperfect, looked to the Party and government leaders much more impressive than a stack of draft blueprints. For example, by hastily refurnishing the metal hulls of *Soyuz* orbital space-

craft for a circumlunar mission, he was able to wrestle this mission's contract away from the rival designer Chelomei, whose design, however original and sophisticated, at that time did not progress much beyond the paper stage.[62]

Space historian Andrew Jenks has characterized Korolev as a "systems builder," drawing on historian of technology Thomas Hughes's seminal analysis of such iconic engineering leaders as Edison, Ford, and Siemens.[63] Korolev's role was indeed largely organizational; he rarely offered his own engineering solutions, and his strength lay in creating new institutions, support networks, and creative teams. Yet unlike the systems builders described by Hughes, Korolev was hardly his own boss. His formal administrative status in the space industry was not high—he was just the head of a design bureau, with multiple layers of ministry bureaucracy above him. He always had to work within a larger system, and his greatest skill was in manipulating this system to advance his agenda. Rather than a "systems builder," he might be more justifiably called a "systems manipulator." The success of his space initiatives rested not so much on the strength of the institutions he created as on his personal organizational and lobbying skills.[64]

Using his fantastic energy and bargaining abilities, Korolev built vast networks of allies and often won arguments with other chief designers and higher officials—heads of industrial ministries, top government bureaucrats, and Party functionaries. Instead of focusing on what was possible within the allotted funding and the prescribed time frame, he started new projects, hoping to get funding and adjust the deadlines later. He stubbornly resisted the decisions he disagreed with, even if they came from the very top. Even the leader of the Communist Party and the Soviet government failed to make him budge, when Korolev bluntly refused Khrushchev's suggestion to use storable rocket fuel. Using this fuel would have shortened launch preparation time and greatly improved combat readiness of ballistic missiles, but Korolev's priorities lay elsewhere. He preferred dual-use rockets that served as both military missiles and spacecraft boosters. For this reason he insisted on cryogenic fuels, which were nontoxic and more efficient and therefore more suitable for space launches, even though it took a day to prepare the rocket for launch, rendering it useless as a practical weapon. Korolev designed his flagship lunar rocket, the N1, for cryogenic fuel, even though he lost the support of the Ministry of Defense, which did not see any military purpose for such rocket.

Korolev's striving for greater authority also had its roots in the Stalin period. In the late 1940s, chief designers like Korolev and Glushko reported directly to the deputy chairman of the Special Committee for Reactive Technology Ustinov, who in turn reported to Stalin. Placing high-priority projects under his personal supervision, Stalin created a management structure that bypassed the multiple levels of bureaucracy separating him from the people

directly involved in these projects. This "shortcut" to the supreme leader gave the chief designers a clear advantage over their immediate ministry superiors and helped them manage the pressures from various parts of the bureaucracy. The rocket engineers' memory of the Stalin era thus featured a phantom, an ideal supreme leader—omniscient, omnipresent, gracious, and infinitely powerful. In their perception, power resided in particular individuals, not bureaucratic structures.

Korolev was convinced of the efficiency of this "shortcut" management structure, and he imitated it within his own design bureau. For every big project, be it a new rocket or a new spacecraft, he appointed a so-called lead designer, who oversaw the production of all components and their integration, cutting across departmental lines. The lead designer reported directly to Korolev, and effectively served as his proxy. As one of such designers recalled, "[Korolev] strengthened the authority of the lead designer, augmenting it with his own authority. The lead designer was often called 'the eyes and the ears of the Chief Designer' or 'the little Chief Designer.' It was a big trust, and to bear it was not easy. One had to work very hard, to know everything—what is being done, where, in what condition—down to the smallest detail."[65]

As historian Susanne Schattenberg has shown, after Khrushchev's denunciation of the "cult of personality," the Stalinist authoritarian management style was increasingly becoming a target of criticism from below. Stalin-era managers were often labeled "little Stalins" and denounced to the authorities. One of such denunciations targeted Ustinov himself, then the Minister of the Armaments Industry. His disgruntled subordinates reported:

> The Minister comrade D. F. Ustinov obviously considers despotism to be the best method of leadership. . . . The collective meeting room functions as a place of execution as under Ivan the Terrible. Cooperation is out of the question, because all members of the staff are frightened and used to voting for decisions made by "HIMSELF." Everybody who falls out of Ustinov's favor, even the most talented employee, will be destroyed by him.[66]

However exaggerated, this characteristic captured Ustinov's direct and forceful style, aimed at cutting through the red tape and getting things done. Suspecting that mid-level managers might hide the truth from him, he used to enter factories unannounced from the back door and to examine the shop floor himself.[67] Korolev similarly often visited workshops with sudden inspections, swiftly assigning blame, dispatching reprimands, and issuing orders. His lead designers stayed on the shop floor practically around the clock, implementing his ideal of constant supervision. Like the notorious "little Stalins," Korolev's "little chief designers" embodied the idea of omniscient, omnipresent authority, which rocket engineers associated with the Stalin era.

In the words of Polly Jones, in the Khrushchev period "the very ideas of stability, control and authority were thrown into question."[68] It was precisely the notions of control and authority that had shaped the professional culture of rocket engineers in the Stalin era. They found these values challenged by the instability and haphazard reforms under Khrushchev, and they resorted to the proven management techniques of the past: professional networking, personal responsibility, and "shortcut" direct control.

In preparation for launching the first piloted *Vostok*, there was one element in the entire system that lay beyond the effective control of space engineers. This element was the cosmonaut himself.

A TINY SCREW IN A GIANT MECHANISM

A key decision that shaped the future of the *Vostok* spacecraft was made by the Council of Chief Designers in 1958. The Council discussed three alternative proposals for a new spacecraft: an automatic reconnaissance satellite, a piloted spacecraft for a ballistic flight, and a piloted spacecraft for an orbital flight. All three proposals emerged from Korolev's Special Design Bureau No. 1; he always preferred to hedge his bets and to develop alternative designs for future projects. The spy satellite designers pushed their proposal, stressing its primary importance for the defense. This clearly had an appeal to the military, the main customers of Korolev's bureau. The proponents of a piloted ballistic flight offered a quick result and a guaranteed win in the race to get a human into space. The third group, led by the integration designer Feoktistov, advanced a more complex design: an orbital piloted mission. They decided to strengthen their proposal by performing what he called a "tactical maneuver." They claimed that their piloted spaceship could easily be converted into a fully automatic spacecraft and used as a reconnaissance satellite, which would be able to return to Earth not just a small container with film but a large capsule with the entire camera set. This promised to kill two birds with one stone! The Council supported Feoktistov's scheme, and he drafted a formal proposal to the Military-Industrial Commission to design a piloted spacecraft in the guise of an automatic spy satellite. Some officials became suspicious when they noticed, for example, that the presumably automatic satellite was equipped with a set of communication devices. "Who is going to talk over this radio—the photo cameras?" they inquired.[69] In April 1959, the Soviet government sent to the Party authorities a secret proposal to construct an automatic reconnaissance satellite. Through personal connections, Korolev was able to add one phrase to the text of the proposal, legitimizing later conversion of the satellite into a piloted spacecraft. The proposal was approved next month.[70]

The forced combination of two totally different missions in a single design —automatic reconnaissance and human flight—resulted in a peculiar config-

uration of the resulting spacecraft. The piloted *Vostok* had to be constructed in such a way as to be easily convertible into a spy satellite named *Zenit* by simply replacing the cosmonaut's couch with a set of photo cameras. Because *Zenit* had to be fully automatic, *Vostok* turned out to be fully automatic as well. The cosmonaut on *Vostok* had only two manual control functions—attitude control and retrorocket firing—to be used in emergency as a backup for failed automatics.[71] The entire *Vostok* piloted mission could be flown without the cosmonaut touching any controls on board the spaceship.

Any potential expansion of the range of manual control functions threatened the well-organized system that ensured the quality and reliability of spacecraft components. Space engineers plainly did not trust the cosmonaut's untested ability to operate onboard equipment while in orbit, in the unusual conditions of zero gravity and psychological stress. Korolev strongly believed that automation produced much more reliable results, and he pressured his subordinates and subcontractors to automate every possible step in the production and operation of space equipment.[72] He trusted a ground operator no more than he trusted a cosmonaut. His discovery that employees at an automatic ground control station performed one of the procedures manually caused his uncontrollable rage.[73]

Giving the cosmonauts access to manually operated systems undermined the space engineers' effort to maintain maximum control over every element of design. Boris Chertok, who was responsible for the entire control system on *Vostok*, formulated Korolev's approach to system engineering as follows: "The properties of every element, every device, every unit, even the human being and his activity must be subordinated to the common interest of system synthesis."[74] As Siddiqi has argued, *Vostok* designers "not only did not trust a pilot's capability to function adequately, but they also wanted to design the craft, fly it, and land it all on their own."[75]

The division of control functions between the human and the machine on board also reflected, as well as affected, the relative influence of the institutions responsible, respectively, for the training of cosmonauts and for the design of automatics. Korolev's design bureau acquired unprecedented control over multiple aspects of the space program. The Air Force, which supervised cosmonaut selection and training, tried to have a greater say in mission programming, but Korolev did not yield decision-making power to any outside agency. In particular, he played a central role in decision making on a whole range of issues going far beyond engineering, such as spacecraft procurement, crew selection, cosmonaut training curriculum, mission planning, and ground flight control. His own role as the unquestionable leader within his design bureau mirrored the central role of his firm in the entire space industry.[76]

The automation of *Vostok* had set a trend that dominated the Soviet pi-

loted space program for decades. Despite the expansion of manual control functions on *Soyuz* ships, the role of the cosmonaut as an emergency backup for automatics fundamentally did not change. Gemini and Apollo astronauts routinely performed manual rendezvous, but *Soyuz* cosmonauts only occasionally had an opportunity to try a manual procedure. Such efforts often failed because engineers' main efforts were aimed at the perfection of automatics, and the cosmonauts were not fully equipped, properly trained, or timely authorized to dock manually in difficult conditions.[77]

The cosmonauts resented this general trend toward automation. Some of them saw its origins in the ideological foundations of the Soviet system. For example, the former cosmonaut candidate Valentina Ponomareva, who served as a backup for Tereshkova, wrote in her memoirs: "'The emphasis on automation' is the result and inherent part of the total mistrust of the individual, the mistrust peculiar to our ideology. . . . Propaganda tried to impose on people's minds the idea that technology decided everything. From this it directly followed that the individual was small and insignificant, and that he was only a tiny 'screw' in a giant mechanism."[78] It appears that this sentiment against Soviet ideology is misplaced. It was not the Party or the government that encouraged automation; it was the space engineers' mind-set of control, which they developed in an attempt to reduce uncertainty and risk, while they dealt with the inadequacies of the overall organization of the space program.

Note historical irony here. Spacecraft designers, some of the most talented, innovative engineers in the country, the cream of the crop of the Soviet technical intelligentsia, at the height of the Thaw built a spacecraft that embodied the notions of control and authority derived from their idealization of the Stalin era. The *Vostok* spacecraft became the technological analog of the totalitarian myth, an omniscient Panopticon that monitored the cosmonaut's every move.[79] Like any other technological artifact, *Vostok* reflected the professional culture of its designers. To the extent that this culture bore an imprint of the Stalin era, one could argue that *Vostok*, the most celebrated artifact of the Thaw, was a flying example of mythologized Stalinism.

DUAL USE, DUAL IDENTITY

The dual controls of *Vostok*—both automatic and manual—reflected the dual use of this spaceship for both military and civilian purposes. As a highly publicized project carried out in closed defense institutions, the space program represented an anomaly, a centaur-like creature. This fostered an unusual split identity of space engineers working at organizations like Korolev's Special Design Bureau No. 1, which developed new types of military missiles alongside space rockets and spaceships. Their original professional identity as secret rocket designers, who worked in isolation from the rest of the world,

clashed with their newly found sense of being (though anonymously) in the spotlight.[80]

Space engineers were excited to see popular enthusiasm over *Sputnik* and the first human spaceflights. Chertok recalled: "The effect produced by *Sputnik* proved totally unexpected. Workers, engineers, and scientific researchers from numerous institutes, design bureaus, and the cosmodrome had believed that they had been doing very important but ordinary work. Suddenly they realized that it was quite extraordinary. Every participant in the design, production, preparation, and launch [of *Sputnik*] felt connection with a scientific feat, with a lustrous day in the history of humankind."[81]

Yet the Soviet leadership decided not to reveal the identity of Korolev or any other leading space engineer, on the grounds that all of them were involved in top secret missile work. The spotlight focused on the cosmonauts, while the chief designers were prominently absent from public ceremonies. Other individuals, often not involved in the space program at all, traveled abroad, gave speeches, and received honors. Korolev was recognized in the press only as "the chief designer" and remained anonymous until his death in 1966. In September 1963, well after *Sputnik* and Gagarin's flight, Korolev was vacationing on the Black Sea and decided to attend a public lecture about Soviet triumphs in space. Nobody in the audience, including the lecturer, had any idea who he was.[82] Even the prospect of receiving the Nobel Prize for *Sputnik* and later for Gagarin's flight did not move the Soviet leadership to reveal Korolev's identity. In response to an inquiry from the Nobel Committee, Khrushchev reportedly said that "the creator of *Sputnik* is the Soviet people."[83] Once Korolev bitterly remarked to an old friend, "I have no public identity, and will probably never have one."[84]

The Soviet space industry was part of the vast rocketry and nuclear weapons military complex, and rocket engineers were subject to the same strict secrecy regulations as the rest of defense industry, or even stricter. The 1957 Ministry of Defense regulations called for "preventing any cases of disclosure in private correspondence or conversations with relatives and friends of any information about the location and true name of a military unit or institution, and about the nature of its work."[85] Private correspondence was routinely screened for state secrets. The stern warnings did not stop a wave of regime violations. In one military unit, for example, in just one month of July 1959, the censors found sixty-two cases of violation of the secrecy regime in private letters. In December 1959 the minister of defense issued a new harsh order "to do away with liberalism and to punish severely those who allow heedlessness and lax vigilance."[86]

The Thaw opened new exciting opportunities for academic scientists to establish contacts with foreign colleagues, travel to international conferences,

and publish abroad. But rocket engineers, despite their direct contribution to a research enterprise of huge international significance, remained isolated from the West. Chertok recalled that in the wake of World War II Korolev and his team "dreamed that instead of the confrontation that had begun to emerge, the interaction of the scientists from the victorious countries would be a natural continuation of the military alliance. In late 1946, Korolev, who had returned from some meeting in Berlin, [told] me, 'Get ready to fly across the ocean.' Alas! Until the very day he died, neither Korolev, nor any one of his closest associates was ever 'across the ocean.'"[87]

Joint work on classified projects, which had to be kept secret even from family members, the specific lifestyle during prolonged stays in the harsh climate and primitive conditions of the cosmodrome, the sense of pride for internationally recognized achievements, and the bitterness about the lack of public recognition—all this strongly reinforced the group identity of rocket engineers. Shared lives bred identical values and interests. One engineer, returning to Moscow from the cosmodrome, picked up the wrong suitcase at the airport and discovered, to his astonishment, that the contents of the suitcase were nearly identical to his: "A shaving set, just like mine, lay in a box; next to it, a few issues of a literary magazine, the same ones I had; the same gloves, helmet, pilot's pants, underwear, and toiletry. Several recently purchased books were almost the same as I had bought while staying at the cosmodrome."[88] The owner of the suitcase was soon found; naturally, he turned out to be another space engineer.

Chertok stressed that rocket engineers often lacked the cultural sophistication usually associated with the intelligentsia: "To act rather than talk, to take risks, to influence the course of events as decisively as possible—this was our working style. Those who burned out were quickly weeded out. It is possible that many in our midst lacked refinement, etiquette, tact, and good breeding. But we all shared an appreciation for a sense of humor, showed consideration for a comrade's work, and tried, if needed, to come to their aid."[89] Indeed, as another memoirist remarked, the manners of the member of the original Council of Chief Designers Mikhail Riazanskii, who was "overtly intelligentsia-like, invariably polite, courteous, and friendly," were an exception from the prevailing pattern among the Council members.[90] Chief designers—tough negotiators and strict administrators—often regarded refined manners a sign of weakness. For example, Korolev at first distrusted the communication systems designer Iurii Bykov. "Bykov's pronounced formality and his outward and inward refinement put Korolev on his guard," recalled Chertok. "Would [Bykov] flinch at a decisive and difficult moment when a cosmonaut's life and the nation's prestige might be at stake?"[91] Eventually Korolev overcame his suspicions, but his initial doubts are telling.

Civilian engineers were always surrounded by military personnel: detachments servicing the launch facility, military specialists testing rocket and spacecraft equipment, and military's top brass supervising launches. In the intermingling of the military and civilians in the rocket and space industry, a curious transitional category of "civilian military personnel" emerged: such was the nickname for military engineers assigned to civilian engineering groups to facilitate the development of rocket technology.[92] Several key positions in the leadership of the rocketry sector of the defense industry were occupied by military officers, for whom an exception was made allowing them to work at civilian institutions while remaining on active duty.[93] The professional culture of rocket engineers became permeated with the spirit and values of military service. Yet their identity remained split: the commitment to the construction of missiles for the defense of the socialist Fatherland clashed with the aspiration to explore space. And they often viewed the former as just the means for the latter.

ELITE ENGINEERS: BETWEEN AUTONOMY AND LOYALTY

Writing his memoirs in the post-Soviet era, Chertok has formulated several traits which, in his view, described typical Soviet rocket engineers: they found the meaning of life in creative engineering work; combined technical work with organizational activity; bore personal responsibility for project results; worked in isolation from their Western counterparts and relied exclusively on domestic technologies; worked in cooperation with researchers from other fields; and identified themselves as members of a "gigantic technocratic system closely associated with the state and with the ideology of a socialist society."[94]

The engineers' belief in a technological utopia fitted well with the Marxist view of the scientific and technological progress as a foundation for building a better society. Unlike many writers, artists, and scientists, space engineers kept a safe distance from any sensitive political issues.[95] As one spacecraft designer admitted, "there were no dissidents among us."[96] Space engineers needed the regime to implement their ambitious space plans, while the regime needed their help in strengthening the defense and raising the nation's prestige. The top engineers were gradually integrated into the country's political elite. The chief designers Korolev, Glushko, Iangel', and Chelomei became delegates at Party congresses, and Glushko and Iangel' joined the ruling Areopagus, the Central Committee of the Communist Party.

In his landmark study, *Technology and Society under Lenin and Stalin*, Kendall Bailes remarked on the following "paradoxical relationship" between the technical intelligentsia and the Soviet state: "Just as the Russian nobility staffed the upper levels of the Tsarist bureaucracy before 1917, and provided

the core of the 'critically-thinking' intelligentsia during the nineteenth century, since Stalin's death, the Soviet technical intelligentsia has emerged as the single largest element from which the ruling elite has been recruited, and also has been a large segment of the new, critically-minded intelligentsia."[97]

This statement appears as a paradox only if one assumes that the ruling elite was monolithic and lacked a critical attitude. The case of the space engineers suggests that this most privileged group of the Soviet technical intelligentsia had a torn identity: the secretive world of postwar rocketry reinforced their affinity with the military, while working on cutting-edge technologies nurtured their sense of belonging to the international techno-scientific elite. Continuous disputes over military and academic priorities in space missions reflected this deep-seated tension in space engineers' identity.

Korolev and other chief designers did not simply use their personal networks to execute government orders more efficiently. They used these networks to recruit allies in pursuing their own vision of space exploration. Korolev designed and built rockets that nominally had a dual use but in fact were much better suited for space exploration than for combat. Chelomei, by contrast, built rockets on storable fuels, won support of the military, and tried to leverage this support to advance his own space projects.

The rocket engineers manipulated the system at least as much as the system was manipulating them. In 1966, trying to curb independent activity on the part of the chief designers, the Military-Industrial Commission set up a formal procedure by which the chief designers could no longer bypass the Commission in their lobbying efforts and had to clear their proposals with the Commission and the Ministry of Defense before appealing to the political leadership. As a former deputy chairman of the Commission admitted, "naturally, this procedure was not always thoroughly followed."[98]

The professional networks of rocket engineers did not merely facilitate the work of the Soviet defense industry. They became channels through which Soviet space policy was formulated, debated, and reshaped. By working in parallel and often in opposition to the established administrative hierarchies, the chief designers were able to develop and promote their own policy initiatives. It was their proposals, reluctantly approved by the Soviet government, that produced *Sputnik*, Gagarin's flight, and the ambitious interplanetary and lunar programs. It was their technocratic vision of the future as a technological utopia that captured the public imagination in the early 1960s. Ironically, just as Soviet society tried to shed the political legacy of Stalinism, it was inspired by products of the engineering culture of the Stalin era.

3 "NEW SOVIET MAN" INSIDE MACHINE

Human Engineering, Spacecraft Design, and the Construction of Communism

ON April 12, 1961, Yuri Gagarin's historic spaceflight shook the world, sending enthusiastic crowds of Soviet citizens into the streets to celebrate. One after another, the Soviet space program boasted new successes—the first group flight, the first woman's flight, the first multicrew mission, and the first spacewalk. For the postwar generation of Soviet people the cosmonauts' triumphs signified an ultimate payoff for years of sacrifice during the war and for Stalin-era privations. "Gagarin's achievement was our greatest pride," recalled one member of the "*Sputnik* generation."[1] According to a 1963 poll, Soviet youth considered Gagarin's flight to be the greatest human achievement of the century.[2]

Cosmonauts became models for the "New Soviet Man," a citizen of the future communist state. The creation of the New Soviet Man was put on the agenda by the new Communist Party program, adopted by the Twenty-Second Party Congress just a few months after Gagarin's flight. Soviet propaganda vividly portrayed cosmonaut heroes bravely flying their spacecraft into the unknown, but the cosmonauts, in fact, were assigned a very limited role on board a spacecraft. Soviet spaceships were fully automated. Although systems of manual control were installed, their functions were severely limited, and they could be used only in case of emergency. The designer of *Vostok*'s manual control system jokingly summed up Gagarin's instructions in four

words: "Do not touch anything!"[3] The Soviet engineers' vision of a manned flight was that of a cosmonaut flying *on board* a spacecraft, rather than flying a spacecraft.

On later spacecraft models, the cosmonauts gradually gained more control functions, but they still served mostly as backup for failed automatics; the standard mode of control remained automatic. Soviet cosmonauts were "designed" as part of a larger technological system; their height and weight were strictly regulated, and their actions were thoroughly programmed. Soviet space politics, one might say, was inscribed on the cosmonauts' bodies and minds, as they had to fit, both physically and mentally, into their spaceships.

The cosmonauts strongly opposed this trend, which they labeled "the domination of automata."[4] With their professional background as pilots, they felt that greater human control of spacecraft would increase the reliability and effectiveness of space missions. Some cosmonauts believed that the domination of automata in the Soviet space program manifested a general ideological attitude toward the individual as an insignificant cog in the wheel.[5] They viewed the strict regulation of their activities as part of a general pattern of social control in the Soviet state.[6] Exploring the tension between the cosmonauts' public identity as icons of communism and their conflicted professional identity may shed light on fundamental contradictions in the Soviet discourse on the communist self in the Khrushchev era.

Historians have long focused their attention on Soviet attempts to reform the human self. The efforts to create the New Soviet Man played a key role in the Soviet project. The "totalitarian model" of Soviet society puts forward "the cog in a wheel" as a central metaphor for the New Soviet Man.[7] This metaphor embodies the notion of the passive individual subsumed under the collective and implies the machine-like operation of the Party and state apparatus controlling social life.

In the past two decades, scholars began questioning the passive nature of the Soviet self and to examine the evolution of the notion of the self in Soviet history. Vladimir Papernyi suggested that two opposing cultural patterns coexisted in Soviet society, dominating in different periods: the first, which privileged the mechanism and collectivism, dominated in the 1920s; the second, which focused on the human and individualism, prevailed in the 1930s–1950s.[8] Igal Halfin and Jochen Hellbeck argued that the Stalinist subject was not merely a passive recipient of official ideology. In their view, young Soviet people internalized communist values and made active attempts to reform themselves, striving for the alluring ideal of the New Soviet Man.[9] Sheila Fitzpatrick found more mundane reasons for individuals' attempts to construct new identities for themselves. Since the Soviet state discriminated

on the basis of class, resourceful individuals often resorted to self-fashioning, impersonation, and outright imposture to claim their "proletarian" origins and revolutionary identity.[10]

The transition from the Stalin era to Khrushchev's political "thaw" led to a marked shift in the prevailing conception of the self. Historians differ on the exact direction of that change. Elena Zubkova has described the Stalin era as an age of collectivism, followed by the "turn to the individual" in the Khrushchev years.[11] Oleg Kharkhordin, by contrast, has suggested a historical trajectory from the collectivism of the 1920s to the individualism of the 1930s–1950s to the new collectivism of the 1960s. He provocatively argues that there was more room for individual freedom under Stalin than under Khrushchev. Whereas Stalinist terror was punitive and haphazard, Khrushchev's policies were aimed at a pervasive rational system of preventive mutual surveillance.[12]

If the Soviet policy on the New Soviet Man is still baffling historians, it must have looked even more confusing to the contemporaries. It is precisely the ambiguity of the New Soviet Man as an ideological construct that is addressed in this chapter. Instead of viewing this ambiguity as a result of policy inconsistencies, I interpret it as a product of fundamental ideological tensions in the Soviet discourse on the self.

Soviet propaganda often used large technological projects, such as the space program, as symbols of the construction of socialism and communism. This chapter examines the notion of the New Soviet Man through its iconic representations—from the heroic aviator in the Stalin period to the cosmonaut in the Khrushchev era. In these cases, the self was viewed as an active agency and, at the same time, defined as part of a technological system. The first quality implied autonomy; the second, discipline and subordination. This tension gave rise to the paradox of "disciplined initiative," which plagued both the cosmonaut self and the New Soviet Man.

"A FLAMING MOTOR FOR A HEART": NEW SOVIET MAN IN THE SKY

In his pioneering study of Soviet technology under Lenin and Stalin, historian Kendall Bailes noted that in the 1930s famous Soviet aviators became "prime exhibits of the 'new Soviet men' whom the authorities wished to create."[13] In April 1934, Mikhail Vodop'ianov, Nikolai Kamanin, and five other pilots, all of whom had distinguished themselves during the Arctic rescue of the crew of the stranded icebreaker SS *Chelyuskin*, became the first Soviet citizens to be awarded the newly established title of Hero of the Soviet Union. As historian Jay Bergman aptly put it, air heroes became "ideological prototypes, precursors of the people who would inhabit the future, from whose achievements . . . the Soviet people could develop a sense of what living under communism would be like."[14]

In November 1933 Stalin put forward a new slogan, calling on Soviet aviators to fly farther, faster, and higher than anyone else, and the Soviet Union jumped into an international race for air records. By 1938 the Soviets claimed to have achieved sixty-two world records, including, as requested by Stalin, the longest, fastest, and highest flights.[15] Aviation became one of the most spectacular "display technologies," showing off the Soviet technological prowess and implying the ideological superiority of the Soviet regime.[16]

As Bailes keenly observed, the regime skillfully exploited the public enthusiasm for aviation to counterbalance the sobering effect of the Great Purges of 1936–1938.[17] As hundreds of thousands perished in prisons and labor camps, Stalin used the celebratory occasions of record flights to stress his personal concern for human life. "Your lives are dearer than any machine," he frequently told aviators, urging them not to take unjustified risks.[18] Yet that was precisely what the aviators had to do in order to set records, so valuable on the propaganda front. In January 1934 the crew of the *Osoaviakhim-1* stratosphere balloon set a new world record in height, dedicating their achievement to the Seventeenth Party Congress. During the flight, however, they pushed the balloon beyond its technological limits and died in the ensuing crash. During the funeral, Stalin personally carried the ashes through Red Square.[19]

The political project of creating the public image of the aviator as New Soviet Man took precedence over the practical demands for the development of modern military aircraft. Concerned largely with the propaganda aspect of aviation as a "display technology," Soviet leaders neglected much-needed technological reforms in the aviation industry. Instead of designing swift, maneuverable aircraft with sophisticated electronic equipment, the Soviets produced heavy, slow, long-distance models, which were good for setting world records but useless in bombing or air combat.[20]

Stalin's famous toast to "the 'little cogs' of a grand state mechanism" at a June 1945 reception celebrating victory in World War II encapsulated a popular cultural image of the individual under Stalin's rule: a necessary but ultimately subservient and replaceable part.[21] The more loudly Stalin proclaimed that human life was "dearer than any machine," the more plainly his actual policies forced individuals to obey the relentless rhythm of the state machine.

The popular culture of the 1930s was filled with man-machine metaphors that reinforced the regime's ideological message. The well-known 1920s song "Aviation March" ("Reason gave us steel wings for arms, and a flaming motor for a heart . . .") was slightly modified in the 1930s to capture the new spirit: the word "reason" was replaced with "Stalin." Visual imagery in public spaces reinforced the metaphorical merger of humans and airplanes as well. For example, the ceiling of the Maiakovskaia subway station, completed in 1938, was decorated with mosaics depicting athletic young men and women soaring in

the sky, "as if they themselves were flying aircraft, technological products of a new Soviet era."[22] Along with aviation, the spectacular Moscow subway system itself became, in the words of a contemporary, "a majestic school in the formation of the new man."[23]

The widely propagated image of the New Soviet Man was filled with inner tensions and ambiguities. The New Man was both a distinct individual and a "little cog"; he strove for personal achievement and wanted to be a good member of the collective; he was to be a master of technology, yet he merged with technology as its intrinsic part. Stalin publicly encouraged air heroes to choose their own course of action during flights, ignoring, if necessary, advice from the ground, and at the same time he instructed them not to take any risks. Paradoxically, "while individual initiative, even disobedience, were qualities that Stalin considered admirable and highly desirable in the new Soviet man, they were also things that, in Stalin's view, would be strictly limited in the communist society he envisioned," a society that would be "rigidly hierarchical" and "informed by an ethos of deference and obedience."[24] The ideological constructs of the New Soviet Man and of the bright communist future did not quite match up. This did not particularly upset professional ideologues, however: those constructs were to be believed rather than rationally examined.

The contradictory nature of Stalin's New Man stemmed from the fundamental ambiguity of Stalinist official discourse.[25] Soviet ideology constantly oscillated between the belief in the power of technology and the trust in active human agency. In 1931 Stalin put forward the slogan, "technology decides everything," calling on the Bolsheviks to master new technology.[26] Although aimed at training technical specialists, the slogan was widely interpreted as a call for the rapid, large-scale production of new machinery. In 1935, renewing his call for an accelerated training of large numbers of loyal technical specialists, Stalin had to explicitly discard his old slogan, admitting that it had acquired a different meaning: "the old slogan, 'technology decides everything,' which reflected the old period which has already ended, when we did not have enough technology, must now be replaced with a new slogan, 'cadres decide everything.'"[27] Despite the clear signal from the top marking a significant ideological shift, public discourse had inertia of its own, and the two slogans—"technology decides everything" and "cadres decide everything"—coexisted in popular writings and speeches for quite a while, creating much confusion about the correct Party priorities with respect to people and machines. Whereas the old slogan presented technology as a measure of progress, the new one placed an equally high value on human skill and personal sacrifice.[28]

In the 1960s the cosmonaut quickly supplanted the aviator as a top model

for the Soviet self. The role of the New Soviet Man in a complex technological system, however, remained ambiguous: will he become the master of technology or its servant?

FROM STALIN'S "FALCONS" TO KOROLEV'S "LITTLE EAGLES"

In the 1930s, the Soviet media habitually referred to the aviation heroes as "Stalin's falcons," implying their "extra-human, and even superhuman, characteristics and abilities."[29] The chief designer of Soviet spacecraft Korolev echoed this cultural image, calling the first cosmonauts "my little eagles." He expected the cosmonauts to be ready for self-sacrifice, just like the famous aviators of the 1930s. At a meeting of the Military-Industrial Commission two weeks before Gagarin's flight, Korolev admitted the considerable risks of the mission but cited the courage of the *Osoaviakhim-1* crew: "They died but held a record for the Soviet Union for 22 years."[30]

Which personal qualities were required of the Soviet cosmonaut became a matter of serious debate. In January 1959 top scientists, physicians, and spacecraft designers gathered at the Soviet Academy of Sciences to discuss the criteria for cosmonaut selection. The physical requirements were clear: because of the small size of the *Vostok* spacecraft, the candidates had to be no taller than 1.75 meters (5 feet 7 inches) and no heavier than 72 kilograms (158 pounds). Opinions divided over the future candidates' professional background. Some participants thought submarine sailors, missile forces officers, and even race car drivers should be considered. Korolev argued, however, that fighter pilots were best prepared for space missions: "A fighter pilot has the universal skills that we need. He flies in the stratosphere on a one-seat airplane. He is a pilot, a navigator, and a radio operator in one. It is also important that he is a regular military man and therefore possesses qualities needed for a future cosmonaut, such as assiduousness, self-discipline, and the unwavering determination to reach the set goal."[31]

Selection was made from among fighter pilots age twenty-five to thirty in perfect health; no requirements were set for their piloting skills. As a result, most of the twenty selected candidates had relatively little flying experience —230 hours in Gagarin's case. The Mercury astronauts, by contrast, had to have a minimum of 1,500 hours of flight time. Nineteen out of the twenty cosmonauts were fighter pilots with no training in engineering; the Mercury seven were skilled test pilots with strong engineering backgrounds. Soviet spacecraft designers believed that the high degree of automation of spacecraft control allowed them to run the entire mission in the automatic or semiautomatic mode, thus making high piloting and engineering skills unnecessary. Korolev explained: "As has been repeatedly demonstrated in our automated flights and those with animals on board, our technology is such that we do

not require, as the American Mercury project does, that our early cosmonauts be skilled engineers."[32]

The task of cosmonaut training was assigned to the Air Force, which in 1960 established the Cosmonaut Training Center in an isolated area 30 kilometers (18 miles) northeast of Moscow, now widely known as Star City. Lieutenant General Nikolai Kamanin was appointed the deputy chief of the Air Force's General Staff in charge of cosmonaut selection and training. It was the same Kamanin who received the highest Soviet honor, Hero of the Soviet Union, for his role in the 1934 *Chelyuskin* rescue mission. One of the most famous aviators of the 1930s, a public icon of Stalin's regime, Kamanin had strong convictions and a commanding personality. He did not hesitate to confront an equally authoritative Korolev and the powerful leadership of the Air Force and the Ministry of Defense whenever they did not go along with his uncompromising views on space policy.

Kamanin's vision of the role of the cosmonauts in the space program forcefully clashed with Korolev's position. While Korolev extolled the virtues of automation and proudly asserted that on his spacecraft even "rabbits could fly,"[33] Kamanin insisted that the cosmonauts be assigned a greater role in spacecraft control.

In preparation for Gagarin's historic launch, Korolev suggested that the cosmonaut should limit his actions during the flight to visual inspection of onboard equipment and should not touch any controls. Korolev's cautious approach may have been prompted by the responsibility placed on him by the political authorities. At a meeting of the Presidium of the Party Central Committee on April 3, 1961, just a few days before Gagarin's launch, Khrushchev raised a question about the cosmonaut's working capacity and psychological stability in orbit. Korolev had to give his personal assurances to the Soviet premier.[34] Not relying entirely on the disciplining force of the cosmonaut's written instructions, spacecraft designers took some technological measures to prevent any accidental damage by the cosmonaut should he lose his psychological stability. They blocked the manual orientation system for reentry with a digital lock. There was some debate whether to give the combination to the cosmonaut or to transmit it over the radio in case of emergency. Eventually, they decided to put the combination in a sealed envelope and to place it on board so the cosmonaut could open it in an emergency.[35]

Kamanin, for his part, proposed giving Gagarin a broader set of functions, such as checking equipment before launch, writing down his observations and instrument readings in the onboard journal, and reporting those over the radio.[36] Flight physicians supported him, arguing that keeping the cosmonaut busy would help deflect his attention from possible negative emotions during g-loads and weightlessness.[37] Kamanin prevailed, and Gagarin performed his

monitoring functions very well, while the flight was conducted in the automatic mode.

Kamanin carefully supervised the official reports given by the cosmonauts after their flights. For example, before the cosmonauts Andriian Nikolaev and Pavel Popovich reported to the State Commission on their *Vostok 3* and *Vostok 4* flights, he had instructed them to say that a human could maintain good working capacity in a prolonged spaceflight, observation equipment should be improved, and the number of human flights greatly increased. Following Kamanin's advice, the cosmonauts insisted that the crew, not the automatics, played the main role on board and asked to broaden the range of manual control functions.[38]

Kamanin envisioned the cosmonaut as a quintessential pilot of a space vehicle, in full control of his craft and of his mission. Korolev, by contrast, viewed the cosmonaut as part of a complex technological system—a part that had to obey the logic of system operations as faithfully as any other part. Despite their conflicting visions of the overall cosmonaut role, the two men often agreed on cosmonaut training, though they emphasized different aspects. Korolev stressed the cosmonaut's ability to fit into the machine, to carry out precisely programmed actions.[39] Kamanin, for his part, demanded strict military discipline and political loyalty. While spacecraft designers standardized cosmonauts' bodies, Air Force officials regularized their minds. Together Korolev and Kamanin attempted to engineer the Soviet cosmonaut, a living embodiment of the New Soviet Man. They were aided in this project by specialists in human engineering.

HUMAN ENGINEERING AND THE DESIGN OF A COSMONAUT

Human engineering emerged in the Soviet Union in the early 1960s under the name *engineering psychology*. This field developed under the wide umbrella of cybernetics and became also known as cybernetic psychology.[40] The Council on Cybernetics of the Soviet Academy of Sciences set up a psychology section, which included a committee on human engineering that coordinated nationwide research in this field. Soviet specialists in engineering psychology defined their discipline as a "study of humans as part of a control system" and included in their area of interest such fields as applied psychology, experimental psychology, biomechanics, psychoacoustics, ergonomics, operations research, and the study of human-machine systems.[41] Adapting the cybernetic conceptual framework, they viewed both humans and machines as cybernetic systems governed by the same feedback mechanism. Blurring the boundary between human and machine, cybernetics legitimized the idea of designing, or human engineering, the self.

The Council on Cybernetics coordinated research on human perception,

information processing, and the effect of emotional states on control functions at several universities and research institutes, including the Air Force Institute of Aviation and Space Medicine. The Institute set up a department of spacecraft simulators, which was responsible for the adaptation of onboard equipment to cosmonauts' psychological and physiological characteristics and for the development of specifications for ground simulators.[42] By early 1967 the Institute had conducted several hundred flight experiments and more than one thousand tests on simulators to find an optimal division of function between human and machine.[43] Moscow University and Leningrad University also conducted a number of studies focused on the human operator on board a spacecraft. They examined statistical characteristics and work efficiency of operators, the interaction among them, and procedures for selection and training of personnel.[44]

Informed by cybernetic psychology, Soviet specialists in human engineering conceptualized the spacecraft control system as a "cybernetic 'human-machine' system."[45] Adapting a cybernetic conceptual framework, they viewed control as a system function that could be performed by either human or machine. They defined the cosmonaut as a "living link"[46] in this system, and analyzed this link in cybernetic terms, borrowed from control theory and information theory—the same terms that applied to the other links in the system. They described the "static and dynamic characteristics" of a human operator in terms of delay time, perception speed, reaction speed, and bandwidth.[47] The "human channel capacity," for example, was estimated at 0.8 bit per second. Based on this estimate, human engineering specialists concluded that, if forced to make a decision within ten seconds, a human could take into account no more than two or three factors.[48] They also discussed how efficiently a human operator could perform the functions of a logical switchboard, an amplifier, an integrator, a differentiator, and a computer.[49]

The cybernetic framework effectively set a standard for evaluating human performance in machine terms. Based on quantitative evaluations, human engineering specialists argued that the human was better than the machine in intelligence, reasoning, and overall flexibility (receiving and processing diverse types of information, learning, and performing diverse tasks). The machine, however, was vastly superior in receiving and processing large amounts of information, performing precise operations, multi-tasking, work capacity, computation, and discarding unnecessary information.[50] Purely human qualities were seen as a mixed blessing: "The machine does not feel boredom, irritation, hesitation in decision making, apathy, fear, or lack of self-confidence. Neither does the machine possess élan, responsibility, the ability to take risks, or imagination."[51]

The psychologists concluded that the human could be either the strongest

or the weakest link in the system, depending on how the functions were divided between human and machine.[52] They formulated the principle of an "active operator" and developed basic guidelines for the joint human/machine, or semiautomatic, control. Researchers recommended, for example, trusting rendezvous and repair operations to the cosmonaut and routine equipment operation to the machine.[53] If these considerations were taken into account, they argued, a human operator could increase the reliability and in some cases reduce the weight and bulk of onboard equipment.[54]

Although these conclusions seemed to support a wider range of functions for the cosmonaut on board, the cybernetic framework underlying this approach fundamentally assigned the human operator a secondary role. Ultimately, the work of the human was to enhance the operation of machines, not the other way around.

OPERATOR TRAINING: TOWARD A PERFECT AUTOMATON

The spacecraft designers tended to be more skeptical about the human abilities in space than were the psychologists. Most engineers viewed the cosmonaut on board as a weak link in a chain, a source of potential errors. For example, Feoktisov openly told the cosmonauts that "in principle, all work will be done by automatic systems in order to avoid any accidental human errors."[55]

The perception of human operators as unreliable was not entirely due to slow human reaction or limited memory capacity. Engineers discovered that quantitative characteristics of human activity in flight often differed from the characteristics measured during ground-training sessions. Thus the main problem was not that the human was not capable; the main problem was that the human was not fully predictable. Engineers therefore recommended that the manual control regime be used only in emergencies.[56] As one candidate cosmonaut put it, "they trusted hardware and did not trust the human being."[57]

Spacecraft designers took to heart the advice of Igor' Poletaev, a leading Soviet cybernetics expert. He suggested that the way to avoid human error was to train the human to operate like a machine: "The less his various human abilities are displayed, the more his work resembles the work of an automaton, the less [the human operator] debates and digresses, the better he carries out his task."[58]

Cosmonaut training was geared toward reducing the fundamental human unpredictability and turning the cosmonaut into a perfect machine. Gagarin recalled how the cosmonauts were "getting used to every button and every tumbler switch, learning all the movements necessary during the flight, making them automatic."[59] The *Vostok 5* pilot, Valerii Bykovskii, was praised in his official evaluation for "the high stability of automation of skill."[60] A cos-

monaut training manual explicitly stated that "the main method of training is repetition."[61]

The planning of cosmonaut activity in orbit was detailed and thorough. The timing and length of every action was predetermined on the ground. For every deviation from the established procedure during the flight, cosmonauts received a citation. An error could be as small as flipping the wrong switch, even if it did not affect the operation of any system. On average, two-person crews accumulated fifty to sixty citations during a long-term orbital mission lasting several months. This amounted to only one or two transgressions per person per week.[62] The cosmonauts truly achieved automaticity in their actions.

The preplanning of cosmonaut activity did not leave them any room for maneuver. If a cosmonaut finished a certain task before the specified time, he or she was not allowed to start the next task earlier than was specified in the schedule. This often led to idling, loss of valuable observation time, and waste of limited resources. During their seven-month-long stay on the Salyut 7 station in 1982, the cosmonauts Anatolii Berezovoi and Valentin Lebedev often chose to perform the most interesting experiments on their days off because on those days they could work at their own pace, without waiting for instructions from the ground.[63]

PSYCHOLOGICAL TRAINING: TOWARD TOTAL SELF-CONTROL

The psychologists who participated in cosmonaut training came largely from the field of aviation psychology, and they conceptualized the cosmonaut activity in essentially the same terms as piloting. They stressed that the activities of the cosmonaut and the pilot had the following characteristics in common: (1) "continuity of work"—constant participation in controlling the most critical phases of flight, even if an autopilot is available; (2) "a mandatory or compulsory order of operations"—no change in the order or length of operations is allowed; (3) "time deficit"—limits on flight operations, reception and processing of information from the ground and from onboard equipment; and (4) "mediated sensory inputs"—hearing is mediated by the radio, vision by optical equipment, and so on.[64]

Psychologists had limited influence within the space program, and their advice was followed selectively. Spacecraft designers embraced the idea of "a mandatory or compulsory order of operations," for it fitted well with their insistence on the automaticity of operations. Yet they were skeptical about the proposed parallels between piloting and cosmonaut work. Chertok wrote: "We engineers, who had designed the control system, believed that it was much simpler to control a spacecraft than an airplane. All the processes are more spread out over time. One has the opportunity to think. A spacecraft isn't go-

ing to go into a tailspin and if a firing of the braking engine is scheduled, then, according to the laws of celestial mechanics, the spacecraft will not depart from its orbit until this deorbit burn takes place."[65]

Spacecraft designers not only denied the significance of the "time deficit" factor but also neglected the principle of continuity of work. They preferred to keep the crew in "cold reserve," passively monitoring the operations of an automatic control system. Only if the automatic system failed was the crew allowed to resort to manual control. The cosmonauts complained that being in cold reserve effectively kept them out of control loop. Without regular participation in control operations, the crew would find it exceedingly difficult to switch from passive observation to active control in case of emergency.[66]

Space psychologists described the model cosmonaut as "a human being with great self-discipline, with a high degree of self-control, capable of thinking clearly and acting decisively in uncertain situations."[67] To prepare them psychologically for the dangers of spaceflight, the trainees were flown on high-performance airplanes and helicopters, performed parachute jumping, and escaped from a submarine through the torpedo compartment. Such life-threatening exercises were meant to re-create the level of emotional tension characteristic of spaceflight.[68] After 1963, when the Soviets mastered the technology of soft landing, parachute jumping was no longer a requisite skill for the cosmonauts. Despite occasional traumas such as broken legs, parachute jumping was retained in the training program as a means of "shaping the psychological makeup of the cosmonaut as a practitioner in a dangerous profession."[69] Cosmonaut training was based on the principle, "the safety of spaceflight through the dangers of training."[70]

Particular attention in cosmonaut training was given to psychological stability in the presence of various disturbing factors. The model cosmonaut, space psychologists argued, "must be able to pick out relevant signals, even in the presence of interfering speech."[71] Cosmonauts were trained to control spacecraft motion and simultaneously monitor eight onboard systems, while being distracted by constant questioning about control panel readings.[72] Gagarin was selected for the first piloted mission based on his mastery of such skills. According to his official evaluation, he "showed high precision in performing various experimental psychological tasks, high resistance to interference from sudden and strong irritants," and "the ability to control himself in various unexpected situations."[73]

Cosmonauts not only had to perform their tasks flawlessly but, just as important, they had to retain perfect composure under stress. During simulated docking tests, the examiners closely watched the trainees' faces. As one cosmonaut recalled, "It was imperative not merely to carry out the procedure, but to do it calmly, confidently, without visible strain."[74]

The trainers tried to boost the cosmonauts' "self-control and self-regulation of action in extreme circumstances" by requiring a continuous verbal report in the course of a complex parachute jump.[75] The cosmonauts were asked to report their every action, velocity, distance to their partners, and so on.[76] By comparing the acoustic characteristics of the reportage with regular speech patterns recorded on the ground, psychologists drew conclusions about the degree of stress and self-control exhibited by the trainee. To avoid being disqualified for the lack of self-control, the cosmonaut candidates had to manage their vocabularies and intonations very carefully, trying to minimize the emotional element in their speech—all while performing a difficult parachute jump.

Speech control proved a useful skill in actual spaceflight. During prolonged flights, psychologists thoroughly analyzed communication sessions to determine the degree of psychological stability of the crew and their ability to continue the flight. As Lebedev, who spent more than seven months on board the Salyut 7 station, confessed, "One must keep himself in check all the time; one must control every word."[77] He likened the need to control speech to "prolonged abstinence from intercourse: it is painful, but it has to be endured."[78] An occasional complaint about fatigue by another cosmonaut drew sarcastic remarks from his crewmates and provoked interpersonal conflict, resulting in his suspension during the mission.[79]

Training cosmonauts to deal with the emotional tension of a life-threatening situation, space psychologists not only placed cosmonaut candidates in dangerous conditions but also used hypnotic experiments. Under hypnosis, experimental subjects were given the instruction, "Your life will depend on how you perform your job. Any error may lead to a catastrophe." The psychologists were hoping that this instruction would hold power even after the subject was awakened from the hypnotic state and instill greater care in the subject's subsequent actions.[80]

Space psychologists suggested that the cosmonauts be trained to endure the feeling of disconnection from the Earth, solitude, limited sensory input, and noise-ridden communications.[81] To prepare for such eventualities, the cosmonauts were confined individually to a "silence chamber" for ten to fifteen days. During the entire period, the experimental subject remained alone, isolated from any outside light, sound, or other sensory input, and limited to four one-way communication sessions a day, during which the subject sent reports but received no reply. The subject's physiological parameters were constantly monitored. The high degree of "emotional stability" displayed by Gagarin during his silence chamber test gave him an important advantage over the other top candidates.[82]

Space psychologists further insisted that the cosmonauts should be trained

to feel equally comfortable in an unlimited ("empty") space and in a narrowly confined space. The candidate cosmonauts were subjected to short-term zero gravity during parabolic trajectory flights on a specially equipped airplane. Psychologists also successfully imposed on the cosmonauts the feeling of a state of weightlessness under hypnosis. They also conducted studies of forced limitation of body movements by restraining subjects' limbs with multiple belts or plaster casts. In contrast to the ecstatic feelings expressed during weightlessness sessions, movement restriction tests led to a "severe psychological condition."[83] Yet one of the most spectacular Soviet space feats—the 1964 launch of a three-man crew on board the *Voskhod* spacecraft—was achieved by exploiting the cosmonauts' ability to operate in a narrow space. Instead of designing a larger spacecraft, Korolev's engineers crammed three cosmonaut seats side by side in the space previously occupied by only one cosmonaut on *Vostok*. As a result, the three cosmonauts had five times less space and air per capita than had the *Vostok* cosmonauts.[84]

Ironically, the extraordinary trials that the cosmonauts went through during their training and actual flights resembled familiar experiences of Soviet citizens. As social life in the Soviet Union was highly regulated, the cosmonauts' activity was also subjected to "a mandatory or compulsory order of operations." As Soviet citizens scrambled to find grains of information in the propaganda-filled official discourse, the cosmonauts trained to "pick out relevant signals" in the presence of noise. As Soviet citizens were virtually isolated from the outside world, the cosmonauts endured isolation tests in a "silence chamber." As the secret police and an army of informers constantly watched ordinary citizens, ready to persecute them for any sign of political disloyalty, physicians constantly monitored the cosmonauts' physiological and psychological parameters, ready to disqualify anyone who showed a deviation from the norm. Most important, as Soviet citizens had to constantly watch themselves not to allow any slip, the cosmonauts had to exercise ultimate self-control, carefully choosing every action and every word. Like ordinary Soviet citizens, the cosmonauts had to follow the rules. One candidate cosmonaut has drawn an explicit analogy: "The social behavior of the Soviet man is strictly regulated; similarly, for the cosmonauts instructions and guidelines of various sorts play a very significant role."[85] Gagarin's extraordinary ability for self-control and his skill in managing surveillance may have played a crucial role in his selection as the first cosmonaut.[86] It seems that because of his dexterity in showing obedience and in playing by the rules, he was indeed well-suited for the role of the New Soviet Man.

The organization of mission control also had profound implications for the cosmonauts' professional identities. Both the cosmonauts and the flight controllers struggled with the question of how to find a proper balance be-

tween personal courage, ingenuity, and creativity and the need to follow a strict sequence of flight operations.

PARADOX OF DISCIPLINED INITIATIVE

Korolev's design bureau was responsible not only for the design and construction but also for the operation of piloted spacecraft during the flight. Spacecraft designers therefore tended to view the cosmonauts as their subordinates. One of Korolev's leading engineers, who later headed the bureau, explained that the managers expected the cosmonauts "to carry out their prescribed tasks just like other employed specialists."[87]

From the very beginning Soviet spacecraft designers adopted a principle followed to this day: all critical systems must have three independent control channels: automatic, remote (from the ground), and manual.[88] Control during the three main stages of the flight—reaching the orbit, orbital flight, and reentry—is automatic; instructions to switch programs between the stages are given either from the ground or manually by the cosmonaut. The cosmonaut, however, has to obtain permission from the ground for any critical action. The norms of cosmonaut activity therefore include not only a technical protocol of interaction with onboard equipment but also a social protocol of subordination to their superiors on the ground. A cosmonaut training manual clearly stipulates that "all the most important decisions are made by Mission Control."[89]

Spacecraft designers believed that comprehensive automation and the strict following of instructions by the crew would best guarantee flight safety, but the cosmonauts pointed out that it was often necessary to break the rules in an emergency. Although the engineers tended to regard any departure from the standard procedure as a human error, it was precisely this ability to deviate from the standard path that made human presence on board so valuable in an emergency situation.

During a space mission, cosmonauts often found themselves in situations unforeseen by mission planners on the ground, situations to which the original instructions did not apply. The crew then faced a dilemma: to follow the rules and fail the mission, or to take risks and break the rules. Such an emergency occurred, for example, during the *Voskhod 2* flight in March 1965. After completing his historic space walk, the cosmonaut Aleksei Leonov realized that his spacesuit had ballooned (his arms and legs were not even touching the inside of the suit), making it impossible for him to reenter the airlock. He was supposed to report all emergencies to the ground and wait for instructions. He later recalled: "At first I thought of reporting what I planned to do to Mission Control, but I decided against it. I did not want to create nervousness on the ground. And anyway, I was the only one who could bring the

situation under control."[90] He may have calculated that various bureaucratic procedures and possible reluctance of some managers to take responsibility could critically delay vital decisions, and it would be unwise for him to spend his limited oxygen supply waiting for them. Taking a risky decision, Leonov drastically reduced internal air pressure of his spacesuit, which allowed him to regain control of his movements. Still he was unable to enter the airlock feet first, which was required in order to squeeze into the landing module. Once Leonov had broken one rule, he decided that he could not make the situation any worse by breaking another, so he climbed into the airlock head first, in violation of the established procedure. He then performed an incredible acrobatic feat by turning around inside a narrow airlock.

The *Voskhod 2* crew—Leonov and Pavel Beliaev, both military pilots—had been trained to follow the rules and to obey orders from the ground. After more than 150 training sessions on a space walk simulator, Leonov was said to have brought his skills "to the point of automatic performance."[91] Yet in a real emergency, Leonov had to perform actions that required deliberation instead of automaticity, to violate explicit rules concerning entry into the airlock, and to make decisions without consulting Mission Control. He thus ensured the success of his mission by *not* acting like a perfect machine.

Control system designers realized that there was a tension between centralized control and the need to maintain what they called "relative autonomy of subsystems and even individual elements,"[92] one such element being the cosmonaut. One of the walls in Korolev's design bureau was adorned with a 1910 memo of the prerevolutionary Russian Navy Engineering Committee: "No manual can enumerate all the responsibilities of an official, account for all individual cases, and provide full instructions ahead of time. For this reason, gentlemen engineers must show initiative and, guided by their specialized knowledge and consideration for the common good, must apply every effort to justify their vocation."[93] "This recommendation," Chertok argued in 1972, "holds true today both for the engineers who control space systems and for the cosmonauts who control spacecraft."[94]

While encouraging initiative, mission planners also made it very difficult for space crews to deviate from their instructions. During their mission on the Salyut 7 station in 1982, the cosmonauts Berezovoi and Lebedev showed remarkable ingenuity in fixing malfunctioning equipment and conducting scientific experiments that would have otherwise been canceled. Yet they received an advice from the ground "to do less improvisation": their performance was evaluated not by the amount of research successfully done on board but by the number of minor errors they occasionally made by trying their innovations. "Here is a paradox," wrote Lebedev in his diary. "If we had not improvised . . . and just followed orders and instructions, the end result

would have been worse, but we would not have had any citations."[95] The engineer cosmonaut Valerii Kubasov drew up a list of ten "cosmonaut's commandments," two of which perfectly illustrated the ambivalence of mission planners about cosmonauts' initiative: "always try to consult with Mission Control, but also take your own initiative"; and "initiative is good, but always try to stick to the rules, otherwise you will be considered undisciplined, and your grades will be lowered."[96]

The cosmonaut self thus fractures into two barely compatible parts: an active autonomous agent and a disciplined subordinate. Ponomareva, a member of the first women's cosmonaut group, has captured this contradiction in her vision of the model cosmonaut:

> The requirements [for being a cosmonaut] are very strict. They include readiness to take risks, the sense of highest responsibility, the ability to carry out complex tasks in harsh conditions, high dependability of the operator's work, advanced intellectual abilities, and physical fortitude. . . . In addition, the cosmonaut must possess such qualities as curiosity and the ability to break rules. . . . Regulations work well only when everything goes as planned. . . . The ability to act in extraordinary situations is a special quality. In order to do that, one has to have inner freedom . . . the ability to make non-trivial decisions and to take non-standard actions. In an extreme situation, the very life of the cosmonaut depends on these qualities.[97]

Nevertheless, two qualities most cultivated in the cosmonauts were self-control and the ability to carry out orders. The women trainees had a particularly hard time coping with the multiplicity of regulations. Ponomareva later recalled: "When we arrived in the center, we were enrolled as privates in the Soviet Air Force. We found ourselves in a military unit, in which we became a foreign element, with our different characters and different ideas. Our commanders had great difficulty dealing with us, since we did not understand the requirements of service regulations, and we did not understand that orders had to be carried out. Military discipline in general was for us an alien and difficult concept."[98] The identity of women trainees was quickly molded to fit the male pattern. The women were soon asked to enlist as officers of the Air Force. They weighed their options, consulted with male cosmonauts, and decided to join the Air Force: "it was necessary to be like everybody else."[99]

The need for the cosmonaut to be both obedient and creative, to follow the rules and to break them, one might call a paradox of "disciplined initiative." Historian Sonja Schmid, in her study of Soviet nuclear power station operators, observed a similar contradiction in the way the operators were viewed by nuclear reactor designers—both as a weak link and a source of reliability

of operations.[100] Both spacecraft designers and nuclear engineers viewed the human operator as part of technology, which must always function according to the rules, yet at the same time they expected the operators to show human qualities such as initiative and inventiveness.

The leaders of the Soviet space program constantly vacillated between the belief in the power of technology and the trust in human skill and creativity. Echoing the duality of Stalin's old slogans, the secretary of the Party Central Committee in charge of the military-industrial complex Ustinov told top space managers in February 1971: "We have to stop swinging from one extreme to the other: either a human being decides everything or a machine decides everything. . . . A human being isn't needed to compete with a machine when it comes to pushing buttons, but [is needed] for research and discoveries, where his heuristic capabilities and mental reserves are needed." He acknowledged that it was difficult to take advantage of human creativity on fully automated spaceships: "We are not yet using these [creative] reserves in space."[101]

One could suggest that this paradox reflected a fundamental contradiction in the Soviet approach to the role of the human in large technological systems and perhaps more broadly to social control and government. According to the "Moral Code of the Builder of Communism," a model Soviet citizen was expected to be an active member of society and to take "an uncompromising attitude" toward any injustice or insincerity. At the same time, an exemplary citizen was supposed to have "a strong sense of social duty."[102] As historian Polly Jones has noted, two opposite trends paradoxically combined in the Khrushchev era: the new emphasis on individual identity, personal well-being, and private freedoms was held in check by the policy of mass mobilization to participate in public events and collective action.[103] Although Stalinism was followed by a political thaw, the Soviet ideological discourse preserved its signature trait—fundamental ambivalence. The new man had to be both an active agent of change and a disciplined member of the collective, dutifully fulfilling the orders. Extraordinary feats performed by heroes did not fit well with the ideal of obedience displayed by loyal team members. A hero both embodied best Soviet qualities and undermined the collectivist message.

NEW SOVIET MAN MEETS AMERICAN HERO

The communist ideal of the 1960s was imagined as a "harmonic merger" of a technological utopia, the construction of a material and technical basis of communism, and a humanist utopia, the creation of the spiritually fulfilled New Soviet Man. The tension between the two parts of this project—technological and human—can be traced throughout Soviet history. Early Bolshevik ideas of the "machinization of man" paradoxically combined traditional images of machinery as an exploitative force with futurist visions of a

creative merger of workers and machines.[104] A similar field of ideological tension was maintained in the 1930s by Stalin's dual slogans, "Technology decides everything!" and "Cadres decide everything!" The aviator hero, who personified Stalin's New Soviet Man, also had a split self—both a distinct individual and a little cog, a master of technology and a part of the machine.

In the space age, the old tensions resurfaced in the debates over automation of spacecraft control. The division of function between human and machine on board determined the cosmonauts' degree of autonomy in controlling their missions and, more broadly, both reflected and shaped the role of the cosmonaut corps within the space program. The cosmonaut identity itself was constructed as part of spacecraft control system design.

The attempts to appropriate the cosmonaut as an exemplar of the New Soviet Man revealed that the chosen model was far from perfect. The cosmonauts resisted their transformation into propaganda icons, just as they resisted their full integration into a technological system. Perhaps they appealed to ordinary Soviet people precisely because they were not perfect embodiments of ideology but living beings with their own thoughts and doubts.

While the Soviets designed the cosmonaut as a prototype for the New Soviet Man, the Americans turned their astronauts into public icons as well. As historian Roger Launius observed, "Both NASA officials and the astronauts themselves carefully molded and controlled their public images every bit as successfully as those of movie idols or rock music stars." Combining youth, vigor, playfulness, and virile masculinity, the astronaut image represented the American ideal, the quintessential American hero. The astronauts served as "surrogates for the society that they represented."[105] Despite the ideological differences, both American and Soviet propaganda magazines presented very similar images of space explorers as both "extraordinary heroes and ordinary human beings" and "shared the basic view that human spaceflight would prove powerfully transformative and would ultimately bring peace and progress to humanity."[106]

Soviet space engineers and cosmonauts often regarded the U.S. space program as a paragon of the human-centered approach to spacecraft design. One of Korolev's deputies, for example, remarked that the Americans trusted the human being, while "we installed heavy trunks full of all sorts of triple-redundant automatic controls."[107] Yet the Soviet perception of the American emphasis on manual control was to a large extent based on a myth. In fact, the astronauts did not manually fly their spacecraft to the Moon and back. As historian David Mindell has shown, a tight coupling of the crew and the onboard computer was required for effective control of Apollo operations. The astronaut served as "a systems manager, coordinating a variety of controls as much as directly controlling himself." Working in close contact with

flight controllers on the ground, the astronauts carried out such crucial operations as spacecraft docking and lunar landing via the computer. Dealing with a computer alarm in the final moments of the *Apollo 11* lunar landing, Neil Armstrong performed the landing manually, and NASA "narrated the landing as the victory of a skilled human operator over fallible automation—a result that highlighted the heroic goals of the program."[108] In fact, as engineers at the Massachusetts Institute of Technology later pointed out, the crew had failed to turn off a switch, which led to computer overload and produced an alarm signal, endangering the mission.

Just like the cosmonauts, the astronauts were working within a complex technological system, and their actions were strictly regulated and controlled from the ground. Both American and Soviet engineers chose to rely on automation, though the means of automation in the American case (the computer) proved more complex and versatile. The cybernetic vision of human-machine merger gave rise to the notion of "cyborg," first formulated by U.S. space psychologists and also contemplated by Soviet physicians.[109] Although they did not resort to cyborg-like modifications of the human body, both American and Soviet specialists in human engineering took an active part in reshaping the space explorer's self. Firm discipline and the ability to function as part of control machinery were equally important for the cosmonauts and the astronauts. In different political contexts, the same professional qualities were reinterpreted to build two opposite ideological constructs—the American "right stuff" and the New Soviet Man.

Ideological declarations of the Cold War rivals differed, but the figures they chose to represent those declarations proved remarkably similar. Both sides viewed the space race as a proxy for the Cold War, and both sides chose to personify the technological competition with a human space explorer. "From a larger perspective, our designers are probably right in their intention to create fully automated piloted spaceships," grudgingly admitted Kamanin in his diary. "Perhaps in the future, when communism triumphs over the entire planet, people will fly into space on such ships. But in our time, one must not forget about the severe struggle between two opposing ideologies."[110] Both in the United States and in the Soviet Union, the main reasons for building piloted ships were political rather than technological or scientific. Instead of showcasing the difference of ideologies, the appropriation of the cosmonauts and astronauts as public icons illustrated the similar dependence of the two superpowers on the Cold War mind-set.

4 THE HUMAN IN THE ARMS OF TECHNOLOGY

Gagarin's Flight in Documents and Stories

> The first spaceships were built not for testing and refining them during spaceflights, but for a guaranteed human flight into outer space. Technology was to take the human into its "arms," not the other way around.
>
> —Oleg Ivanovskii, lead designer of *Vostok*

IN the Soviet Union there was only one official version of space history, and it was tirelessly reproduced in various memoirs, fiction books, and movies. In that version, everything worked perfectly, and Gagarin smiled all the way from the launch pad to Red Square. In the closed circles of space engineers and cosmonauts, however, various legends circulated, gradually acquiring lifelike detail and a mythological status. With the advent of perestroika, and especially after the collapse of censorship in the first post-Soviet years, multiple versions of history proliferated. Cosmonauts, engineers, military personnel, physicians, mathematicians, technicians, and other witnesses began to tell their stories. By that time, the memories faded, and recollections became loaded with legends piled up over the decades. Instead of a single official myth, multiple myths sprang up, often built around specific individuals or institutions.[1]

In the past few years, as important primary sources—previously classified official documents, flight audio recordings, contemporary diaries, and engineers' notes—became available to researchers, this provided an opportunity to start piecing together a more comprehensive story of the first human spaceflight. Rather than presenting a single streamlined narrative of events, however, this chapter will attempt to tell the story in multiple voices, to express the fascinating complexity of positions, perceptions, and opinions, illuminated or obscured by specific viewpoints of various participants and commentators.

A historical event is more than a naked fact; the richness of its meaning lies in the living experience of all people involved, from the main protagonist to a chance observer. The story of Gagarin's flight is much more than a register of the cosmonaut's actions and technology's functions and malfunctions. Every twist and turn in the story profoundly affected many participants—from leading spacecraft designers to the military top brass to high-ranking Party officials. All of them had a vested interest in the success of Gagarin's mission, and some of them disagreed over how the mission should be conducted. Gagarin's flight encapsulated key tensions in the Soviet human space program—different visions of spaceflight, debates over the division of function between human and machine, risk and responsibility, and flight publicity and secrecy—and the events of the flight echoed the earlier debates.

This chapter uses Gagarin's flight as a window into the world of Soviet cosmonautics. Each voice behind a diary entry or a technical report is filled with inner tension and often a hidden emotion. Each step of the mission was someone's responsibility, and the interests of different professional groups clashed over various aspects of the flight. The distinct identities of these groups were illuminated at these critical moments, when everything was at stake. An official, an engineer, a physician, or a journalist—all stand out not only in what they contributed to the event but also in how they tell their story.

Gagarin's flight is the greatest story of Soviet cosmonautics, told endless times by all participants. With each telling, the story was embellished and gradually grew into a myth. The multiple facets of one event, viewed from different viewpoints, eventually developed into multiple myths, passed from one generation to another as part of the professional culture of these groups. I go to the origin of these stories to unearth the foundational myths of space professions, tied to their distinct identities, just as national identities are knotted to the foundational myths of nation states. Instead of a single, measured official tone of the TASS news agency, I present many anxious voices of closely involved participants.[2]

DOCUMENT
Vostok Mission Assignment, approved on April 8, 1961

> Execute a single-orbit flight around Earth at an altitude of 180 to 230 kilometers [112 to 143 miles] lasting 1 hour 30 minutes with a landing in a predetermined area. The flight objective is to verify a human being's ability to stay in a specially equipped spacecraft, test the spacecraft equipment in flight, test the spacecraft's communications with the ground, and confirm the reliability of the spacecraft's and cosmonaut's landing systems.[3]

Like many important official documents, the *Vostok* mission assignment was a difficult compromise. It was composed by the cosmonaut training department at the Special Design Bureau No. 1, which designed and built the *Vostok* spacecraft, with the participation of the cosmonauts themselves.[4] The final editing was done by two key figures in the Soviet human space program—Chief Designer Sergei Korolev and Lieutenant General Nikolai Kamanin. Kamanin's vision of the role of cosmonauts in space missions forcefully clashed with Korolev's. While Korolev extolled the virtues of automation and proudly asserted that on his spacecraft even "rabbits could fly," Kamanin insisted that the cosmonauts be assigned a greater role in spacecraft control.[5]

This document reflected a tension between the positions of the two men and the powerful groups they represented. Korolev, speaking for the space industry, viewed the human role on board during the *Vostok* flight as mere "presence." The Soviet engineers' vision of a manned flight was that of "a 'man on board' rather than a pilot flying."[6] A manual control system was installed on *Vostok*, but its functions and use were severely limited. There were only two manual control functions available, attitude correction and retrorocket firing for reentry, and they could be used only in emergency.[7] A technical report on *Vostok* signed by Korolev two weeks before launch clearly stated when the cosmonaut could step in: "In case of failure of the [automatic] solar orientation system, the spacecraft orientation for reentry can be performed by the pilot using the optical orientation device and the manual control system."[8] If everything went well, the cosmonaut did not have to—in fact, was forbidden to—use any controls. Speaking for the Air Force and for the cosmonauts, Kamanin put up a fight, resisting the engineers' efforts to reduce the first cosmonaut's activities during the flight. Assigning the cosmonaut even such minimal tasks as equipment checks and radio communications became a matter of heated debates.

A GENERAL'S STORY
Lieutenant General Nikolai Kamanin's Diary

March 2, 1961. Today, for over three hours, I, Korolev, Iazdovskii, Gallai, Alekseev and other people were revising Instructions for the Cosmonaut, which had been composed by six cosmonauts together with representatives of the Special Design Bureau No. 1 . . .

Korolev, Keldysh, Bushuev and Voskresenskii insisted on a significant reduction of the text of the Instructions. In particular, they suggested that after an engineer checks onboard equipment Gagarin should check his spacesuit and radio communications, and only visually inspect the rest of the equipment. In essence, these proposals would drastically limit the activ-

ity of the cosmonaut during pre-launch preparations and in flight. Korolev argued that in a single-orbit flight all the equipment would work flawlessly in the automatic mode, without the pilot's interference.

We—Iazdovskii, Gallai, Smirnov, and myself—were radically opposed to limiting the pilot's activity. Our arguments were as follows. The cosmonauts know very well both the ship equipment and their own capabilities to control the ship in case of forced manual descent (after unlocking the control panel lock). They would feel more confident if they personally perform equipment checks. Besides, while conducting a complete pre-launch equipment check, observing various phenomena during the flight, writing down his impressions and instrument readings in the onboard journal, and reporting them over the radio, the cosmonaut would be kept busy all the time. Keeping the cosmonaut constantly busy would deflect his attention from possible negative emotions under g-load and in zero gravity. In addition, we would be able to obtain much valuable information for training for subsequent flights.

After rather prolonged debates Korolev and Keldysh agreed with our point of view, and Korolev and I signed the original text of the Instructions with minor revisions.[9]

The *Instructions* included provisions for various emergencies, such as communication failures, cabin depressurization, and fire on board. In case of fire, the cosmonaut was to make a report and perform an immediate landing. In case of cabin depressurization, there was no immediate danger, because the cosmonaut was in a pressurized suit; the flight could be continued for up to four hours, and the landing was to be performed on command from the ground or with manual control.[10]

Two weeks later Kamanin discussed the revised text of the *Instructions* with the rest of the cosmonaut corps. They proposed several changes aimed at giving the cosmonaut a bit more freedom for action. They proposed to let the cosmonaut loosen the suspension straps after reaching the orbit, to put on the space gloves only fifteen minutes before the liftoff instead of ninety minutes, and to keep a log journal during the flight. They also unanimously insisted on giving the cosmonaut the possibility to block the release of the backup parachute if the main parachute fully deployed. Kamanin was able to incorporate all the suggestions except the last one. Making last-minute changes in the automatics was out of the question, but Kamanin promised to raise this issue for later flights.[11]

On March 29, 1961, the State Commission on the Launch of *Vostok* gathered to hear Korolev's progress report. He said that two recent launches of unmanned *Vostok* on March 9 and 25 were successful, and declared that both

the booster rocket and the *Vostok* spacecraft were ready for human flight. After the discussion, the Commission chairman Konstantin Rudnev made a roll call, asking everyone personally whether he would support launching a cosmonaut on the next flight. Everybody concurred. The matter then moved up the chain of command to the chairman of the Military-Industrial Commission of the USSR Council of Ministers Ustinov.[12]

AN ENGINEER'S STORY
Notes taken by Boris Chertok, Korolev's deputy in charge of spacecraft control

29 March 1961. At 18:30 meeting in the Kremlin with Dmitrii Fedorovich [Ustinov]. . . . [Korolev speaks:]

1) Everything is reliable. Any new [test] launches would not add anything.

2) Publicize right after reaching the orbit to establish our priority just in case. Citing the example of the USSR stratosphere balloon, Usyskin et al. "They died but held a record for the USSR for 22 years."

Deputy chairman of the KGB supported all the proposals but suggested to take a look at what could be destroyed in case of landing on foreign soil. SP [Korolev] said, "It's a very fortunate trajectory. If the [third stage] engine fails in less than 236 seconds, [landing] on our territory; between 236 and 272 seconds, in the [Pacific] Ocean before Cape Horn. After 273 seconds, it's already a satellite. That is, only one second for the Atlantic Ocean, Africa, Turkey, and the Black Sea."

Which is better—death in the ocean or life after landing on foreign soil?[13]

The Soviet leadership apparently worried more about Gagarin's landing in a foreign country than about falling into the ocean. Korolev evidently admitted the considerable risks of the *Vostok* mission, but in his view, for an undertaking of such magnitude, high risks were acceptable. He cited the courage of the crew of the Soviet stratosphere balloon *Osoaviakhim-1*, who in January 1934 achieved a new world altitude record at the price of their lives.[14] Two months later, the Soviet Academy of Sciences held a conference on the study of the stratosphere. At the conference, Sergei Korolev, then a little-known rocketry specialist, proclaimed, "In order to defeat the enemy, we must know him. Today's 'enemy' for the scientists is the stratosphere."[15] Korolev, now the chief designer of Soviet spacecraft, expected the cosmonauts to be ready for self-sacrifice, just like the famous aviators of the 1930s.

After clearing the Military-Industrial Commission, only one hurdle remained before the launch of *Vostok* could receive a green light—to obtain an approval from the Presidium of the Communist Party's Central Committee, the ruling political body of the Soviet Union. On March 30, top military brass and defense industry leaders submitted a joint memorandum to the Party

leadership, proposing to launch a piloted spacecraft into orbit between April 10 and April 20. They gave assurances of the safety of the proposed mission, citing positive results of recent flight tests of the unmanned version, *Vostok 1*, and its modification for the piloted flight, *Vostok 3A*.

DOCUMENT
Memorandum to the Party Central Committee, March 30, 1961

> Three out of five launches of the spacecraft *Vostok 1* ended satisfactorily and provided extensive material for securing safe spacecraft flights in the future. Two subsequent launches of the spacecraft *Vostok 3A*, identical in design to the one intended for human spaceflight, were successful.[16]

The authors of the memorandum spared the political leadership from the details of these test launches. In fact, out of five launches of the unmanned version of *Vostok* attempted in 1960, only four took off, three reached an orbit, two returned to Earth, and only one had a normal landing.[17] The two tests of the 3A version also had some problems. The actual landing points lay 412 kilometers (256 miles) and 660 kilometers (410 miles), respectively, from the planned sites. Besides, during reentry the descent module did not fully separate from the instrument compartment: the sections were pushed apart but remained connected by an outer electrical cable. The linked pair tumbled wildly on descent until the cable burned down in the heat of reentry. As it turned out, the cable failed to disconnect because of a basic design error: the signal to disconnect was sent through a wire that was cut off when the sections were pushed apart, and the signal simply could not reach the cable plate. To fix this error by redesigning electrical circuitry was very easy, but a new round of comprehensive testing would have caused unacceptable delays, and the engineers decided that the burning of the cable worked just as reliably as disconnection by a signal.[18]

Although Korolev apparently thought that the political leadership did not need to know such potentially disturbing facts, he wanted to make sure that the cosmonauts were not relying on rosy public reports but were aware of the true magnitude of risk. On March 18, he met with the cosmonauts and discussed some of the equipment failures during the test flights and the measures taken to fix the problems. The cosmonauts eagerly expressed their readiness to fly "right now" despite all the technical glitches, leaving Korolev fully satisfied.[19] He failed to mention to them the problem with cable disconnection, and the tumbling of spacecraft on descent later came as a total surprise to the cosmonauts who experienced it.

The fateful meeting of the Soviet political leadership discussing the launch of *Vostok* took place on April 3, 1961. It did not go smoothly. Khrushchev felt

Korolev's uneasiness but, assured of the reliability of the technology, suspected that the cosmonaut himself could be a weak link.

A GENERAL'S STORY

Lieutenant General Nikolai Kamanin's Diary

April 4, 1961. During the first flight, one will have to face a lot of new and totally unexpected things. Not surprisingly, yesterday at a meeting of the Presidium of the Party Central Committee Nikita Sergeevich [Khrushchev] asked, "Who has the knowledge of how the cosmonaut would act in the first minutes of flight? Might he become very sick? Would he be able to maintain his work capacity, his restraint, and his psychological balance?" Nobody present could give Khrushchev a definitive and unambiguous answer. Without going into details, Korolev replied, "The cosmonauts' preparation is excellent; they know the ship and the conditions of the flight better than I do, and they feel confidence in themselves."

Self-confidence is a good thing. One must feel confident when embarking on such a big and important enterprise as the first human spaceflight. I also believe in success, and my confidence is based on my knowledge of technology, of the people who will fly, and on certain knowledge of flight conditions. But there isn't and will never be "100 percent" confidence in the success of a spaceflight, especially the first one.[20]

Kamanin's story depicts an overconfident Korolev putting up a show for the Party bosses. Was Korolev's confidence part of the show as well? Khrushchev span his own story, writing in his memoirs that he and other leaders "worshipped" Korolev.[21] But would they still have worshipped him if anything went wrong? Among all the signatories of the memorandum, Korolev had the lowest bureaucratic rank. Yet, being fully aware that no one would volunteer to take responsibility, he stepped up to the plate. The Party leadership was satisfied. They knew whom to thank for success. And whom to punish for failure.

DOCUMENT

Resolution of the Presidium of the Communist Party Central Committee, "On the Launch of a Spaceship-Satellite," April 3, 1961

Strictly Secret

Special File

1. The proposal by Ustinov, Rudnev, Kalmykov, Dement'ev, Butoma, Moskalenko, Vershinin, Keldysh, Ivashutin, and Korolev on the launch of a spaceship-satellite *Vostok 3A* with a cosmonaut on board is approved.

2. The draft announcements of the Telegraph Agency of the Soviet

> Union about the launch of a spaceship with a cosmonaut on board are approved. The authority to make revisions if necessary, based on the launch results, is granted to the Launch Commission. The authority to publish the announcement is granted to the Military-Industrial Commission of the Presidium of the USSR Council of Ministers.[22]

Three versions of a public announcement about the first human spaceflight were prepared in advance by the Scientific Research Institute No. 4 of the Ministry of Defense. They were delivered to the TASS news agency, radio, and television stations in three sealed envelopes. A special order would specify which envelope to open, depending on the circumstances. If the cosmonaut successfully reached the orbit, the first envelope would be open. In a rare instance of openness, it was decided to make a public announcement while the flight was in progress, not after the fact. Korolev and other leaders insisted on such early announcement to facilitate the search for the cosmonaut and to eliminate the chance of mistaking him for a spy. The plan was to make an announcement as soon as the actual orbital data were obtained and inserted into the text, approximately twenty-five minutes after the launch. The second envelope would be open if the cosmonaut successfully landed on the Soviet territory. The third envelope was prepared in case the flight was aborted before reaching the orbit and resulted in an emergency landing on foreign soil or in the ocean. For such an occurrence, the third announcement included a call for all nations and governments to render assistance in the search and rescue effort.[23]

While the drafts of public announcements were discussed, a debate broke out over the term that would describe the activity of the cosmonaut. Despite the limited range of activities assigned to the first cosmonaut, it was decided to call him "pilot-cosmonaut" in anticipation of more complex flights in which piloting skills would indeed be needed.[24]

With a week to go before the flight, the question whom to choose for the first flight, Gagarin or Titov, was still up in the air. Kamanin agonized over this issue, weighing the pros and cons of the two candidates. "It is hard to decide whom to send to a certain death," he wrote in his diary, "and it is equally hard to decide whom of the two or three deserving men to make a world celebrity, whose name will be forever preserved in the history of humankind."[25]

A GENERAL'S STORY
Lieutenant General Nikolai Kamanin's Diary

> *April 5, 1961. In the past few days and even now, as I am writing these lines, one and the same thought is relentlessly pursuing me: whom to send to the*

first flight, Gagarin or Titov? Both are excellent candidates, but in the past few days I have been hearing more remarks in support of Titov, and my own trust in him has been growing. Titov performs all exercises and training sets more accurately and precisely and never talks more than necessary. Gagarin, on the other hand, expressed his doubts about the necessity for automatic deployment of the backup parachute; also, during a flight over the area of projected landing, he looked over the bare, ice-covered land and sighed, "Yeah, one could tumble pretty hard down there."[26]

Kamanin pondered how to interpret Gagarin's remark—as a clear-headed evaluation of landing conditions or as the first sign of wavering and weak will? For the next few days, Kamanin continued watching Gagarin and Titov intently, noting Gagarin's "calm, self-confidence, and solid knowledge." Kamanin felt that Titov had a stronger will but decided that the better prepared cosmonaut would be needed for the second, much longer and difficult flight. On April 8, at a meeting of the State Commission for the Launch of *Vostok*, Kamanin announced his choice of Yuri Gagarin as the pilot and Gherman Titov as his backup. The Commission unanimously confirmed his choice.[27]

Another important question debated at the April 8 meeting of the State Commission was whether to give the cosmonaut the combination for the so-called logical lock. Not relying entirely on the disciplining force of the cosmonaut's written instructions, spacecraft designers took some technological measures to prevent any accidental damage from cosmonaut's actions in case he lost his psychological stability in orbit. They blocked the manual orientation system for reentry with a "logical" (digital combination) lock. Presumably, if the cosmonaut had enough presence of mind to punch in three keys in a particular order, he would prove his ability to make a reasonable landing decision.

AN INSTRUCTOR'S STORY

Memoirs of Mark Gallai, a spacecraft control instructor

The switch from automatic to manual control on Vostok was deliberately made difficult. After discovering a malfunction in the automatic system, the cosmonaut had to pass through a special "logical lock": to enter a three-digit combination on a six-digit keypad, and only after that could he turn on manual control. . . .

Gagarin, his backup Titov, and the rest of the group of six cosmonauts reliably learned this operation on a special simulator . . .

Yet about a week before the Vostok flight, on the cosmodrome, the situa-

tion suddenly got complicated. Someone proposed that, in order to avoid the possibility of unjustified use of the manual control system, the combination would be transmitted, in case of emergency, over the radio . . .

A heated battle ensued! Everyone involved in cosmonaut training energetically opposed this idea.

—Let's compare,—we argued,—which is more probable: a loss of human ability to act rationally or a routine failure of radio communications? . . .

—Let's give him the darn combination in a sealed envelope,—said the Chief [Designer Korolev].[28]

The day before launch Kamanin, Gallai, and the lead designer of *Vostok* Oleg Ivanovskii installed a code plug into the lock and signed a protocol which listed the three secret numbers. The combination was written on the inside of an envelope; the envelope was sealed and taped to the wall of the space capsule.

On the eve of the launch Gagarin sat down to write a letter to his family—his wife, Valentina, whom he lovingly called Valechka or Valiusha; the two-year-old daughter, Elena (Lenochka); and the newborn daughter, Galina (Galochka). His wife knew that the first piloted launch might occur within days, but she did not know whether Yuri was chosen. Neither did she know the exact date: Yuri did not want to worry her and told her that the probable date was April 14. Gagarin wrote the letter on April 10, Elena's birthday, but he did not mention this in the letter. Other things were on his mind.

A COSMONAUT'S LETTER
Gagarin's letter to his family, April 10, 1961

My dear beloved Valechka, Lenochka, and Galochka!

I decided to write you a few lines to share with you the joy and happiness that befell me today. Today the government commission decided to send me to the first spaceflight. I am so glad, dear Valiusha, and I want you to share this joy with me. An ordinary man, I have been trusted with an important national mission—to pave the first road into space! . . .

I fully trust the technology. It should not fail. But it sometimes happens that a man falls and breaks his neck with no reason at all. Something may happen here too. I do not believe it will happen. But if it does, I ask all of you and especially you, Valiusha,—do not be overcome with grief. Such is life. . . . Please take care of our girls and love them just like I do. Please raise them as . . . true human beings who are not afraid of the challenges of life. Raise them as people who will deserve to live a new communist society. . . .

This letter is coming out a bit too gloomy. I do not believe in this [bad]

outcome. I hope you will never see this letter, and I will feel ashamed for this momentary weakness. But if something happens, you must know the whole truth.

When I was a child, I once read the words of Valerii Chkalov, "If you are to be, be the first." So I try, and I will to the end. Valechka, I wish to dedicate this flight to the people of the new communist society, which we are already entering, to our great Motherland, and to our science.

I hope in a few days we will be together again, and we will be happy. Valechka, please, do not forget my parents, and if you have an opportunity, help them somehow. Give them my warm greetings, and let them forgive me for not telling them about this, for they were not supposed to know. This is it, I think.

Good bye, my dears. I hug you tightly and kiss you.

Greetings,

Your daddy and Yura.[29]

Gagarin and Titov were closely monitored until the last minute. On the eve of the launch, the chief physician Vladimir Iazdovskii secretly installed tension sensors under their mattresses to monitor their sleep. Two specialists, an engineer and a psychologist, stayed on duty all night monitoring every toss and turn for a sign of anxiety. Both cosmonauts slept soundly. Korolev did not sleep for a minute. He may have required doctor's attention much more than the cosmonauts did.[30]

Punctuality itself, Kamanin compiled a minute-by-minute schedule for the cosmonauts on the morning of the launch:[31]

5:30 am (local time): waking up
5:30–6:00 (30 min.): bathroom; physical exercise
6:00–6:15 (15 min.): breakfast
6:15–6:25 (10 min.): ride to the assembly test building
6:25–7:15 (50 min.): medical check-up

At the check-up, physicians attached eleven sensors to Gagarin's body, from the chest to the feet.[32]

A PHYSICIAN'S STORY
Interview with Ada Kotovskaia, a senior physiologist at the Institute of Aviation Medicine

Did Yuri feel anxiety before launch? Yes, he did! When we were checking the sensors for the last time and giving him our instructions, he was quiet, focused, and very somber. He occasionally hummed some popular songs, but most of the time he kept silent. The cardiogram taken four hours before

launch clearly shows that Gagarin was anxious. Who would not be? He simply knew how to keep his emotions in check.[33]

7:15–8:45 (90 min.): putting on and checking the space suit
8:45–9:00 (15 min.): ride to the launch pad

A GENERAL'S STORY
Lieutenant General Nikolai Kamanin's Diary

April 12, 1961. The planned schedule was followed with great difficulty. After leaving the bus, Yuri and his friends became somewhat emotional and started hugging and kissing each other. Instead of wishing him a good journey, some bade farewell and even cried. The cosmonaut had to be pulled away from the arms of his companions by force.[34]

Oleg Ivanovskii and the lead engineer Fedor Vostokov accompanied Gagarin to the top of the rocket and helped him climb into the capsule. They were about to close the hatch when Ivanovskii suddenly called Gagarin.

AN ENGINEER'S STORY
Memoirs of Oleg Ivanovskii, the lead designer for the *Vostok* mission

—Yura, those three digits on the lock,—I pointed to the envelope,—are 1, 2, 5. Clear? I am telling you a secret.

—Oh yeah, a big secret. We'll manage fine without it. And by the way, you are late.

—What do you mean?

—Gallai told me the combination yesterday,—Gagarin winked and smiled.[35]

When the hatch was closed, the indicator panel down in the control room showed that one of the electrical terminals on the hatch did not make contact, which could mean the lack of hermetic seal. Taking the hatch off and closing it again took some thirty minutes. There were no second goodbyes. Time was running short.

Gagarin took his seat in the space capsule two hours before launch. Kamanin and the team of physicians had tried to convince the engineers to reduce the waiting time to one and a half hours, but the cycle of booster and spacecraft preparations could not be shortened.[36] Extra operations such as the re-sealing of the hatch had to be squeezed into an already packed schedule.

Kamanin, Korolev, and the capcom Pavel Popovich feared that if Gagarin waited passively for launch he would be overcome with anxiety, and they kept him busy with nonstop radio exchanges. Gagarin's call sign was *Kedr* (Cedar);

the ground control shortwave stations had call signs *Zaria* (Dawn) *1* for the Tyuratam cosmodrome in Kazakhstan, *Zaria 2* for the Kolpashevo station in Siberia, and *Zaria 3* for the Elizovo station in the Far East; the ultra high frequency (UHF) stations used the call sign *Vesna* (Spring). No names, except for the name of the cosmonaut, could be said over the open airwaves. For communications purposes, Korolev and Kamanin were code-named Number 20 and Number 33, respectively.

COMMUNICATIONS TRANSCRIPT

Gagarin's pre-flight communications, 7:28–7:32 am (Moscow time), April 12, 1961

Zaria 1 (Korolev): How are you, Yuri Alekseevich?

Kedr (Gagarin): I'm feeling fine. The check of the telephones and the speakers is normal. I'm switching to the telephone.

Zaria 1 (Korolev): Everything is going normally; the machine is being prepared normally; everything is well.

Kedr (Gagarin): I thought so.

Zaria 1 (Korolev): Good, everything is normal.

Kedr (Gagarin): The communications check is completed. The initial positions of tumbler switches on the panel are as specified. The Globus device is set for the separation point, latitude 63 degrees North, longitude 97 degrees East, correction number 710, separation time 9 hours 18 minutes 07 seconds. The mobile index of the descent mode monitor is set in the initial position. Day one; daytime. Air pressure in the cabin 1, humidity 65%, temperature 19 degrees, pressure in the [instrument] compartment 1.2, pressure in the manual control system 175, in the first automatic attitude control system 155, in the second automatic system 157, pressure in the retrorocket tank 320 atmospheres. I'm feeling well, ready for launch.

Zaria 1 (Korolev): I've received your data and confirm it. Readiness for launch is acknowledged. Everything is normal here. . . . Yuri Alekseevich, I only want to remind you that after the "one-minute-to-launch" signal some six minutes will pass before the liftoff. So don't get worried.

Kedr (Gagarin): I am totally calm.[37]

Gagarin's pre-flight communications, 8:40–8:41 am

Kedr (Gagarin): What does the medicine say—is the heart beating? . . .

Zaria 1 (Kamanin): Your pulse is 64, respiration 24 [breaths per minute]. Everything is going normally.

Kedr (Gagarin): This means the heart is beating.[38]

The communications were broadcast in the control room through loudspeakers, and the news of Gagarin's perfectly normal heart rate caused some excitement among the engineers in the extremely tense atmosphere of launch preparations.

AN ENGINEER'S STORY

Interview with Leonid Voskresenskii, Korolev's deputy in charge of preflight testing

> *I think on April 12 Gagarin was the calmest person on the launch pad. Not long before launch, his heart rate was 65. I saw how others, upon hearing this, began taking their own pulse. Among the members of the launch team, the heart rate was somewhere between 100 and 120.*[39]

In the two hours that Gagarin spent on the launch pad, he assured Ground Control of his perfect health condition twelve times, while Ground Control told him that the launch preparations were proceeding normally nineteen times.

Gagarin checked the onboard equipment and found that the tape recorder was not recording. He guessed that the tape had ended and asked the ground control to rewind it. It was a trivial operation, yet it was performed by automatics after a command from the ground. Ground engineers offer a different version of events.

ENGINEERS' STORY

Recollections of Iurii Karpov and Vladimir Khil'chenko, engineers from Korolev's bureau

> *Two minutes before launch, on the Vostok panel, which we monitored in an underground bunker, a sign lit up, "The end of tape recording." It turned out, Yuri had almost continuously sung songs and used up all the tape. There was no time for discussion; there was only one minute left before we would lose an electric connection with the spaceship, so we took the risk and rewound the tape . . . Because of this, Ground Control lost a channel of communication with the cosmonaut for 50 seconds, which caused some confusion, but in a minute everyone calmed down.*[40]

The communication transcript confirms, however, that Gagarin himself asked to rewind the tape nineteen minutes before launch.[41] Later it turned out that the perfect automatics did not fully rewind the tape. Gagarin ran out of tape while in orbit, and had to erase part of the audio to continue recording.[42]

Gagarin remained mostly calm, but five minutes before launch his heart rate jumped to 110–133.[43] It climbed to 150 in the first minute of flight.[44]

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:07 am

> **Zaria 1 (Korolev)**: Preliminary stage . . . Intermediary . . . Main . . . Lift-off!
> **Kedr (Gagarin)**: Off we go![45]

Gagarin's famous phrase "Off we go!" (*Poekhali*!) would later become a motto of the entire Soviet space program, an emblem of the youthful exuberance of space travel. Several individuals contended for the honor of having taught Gagarin the expression. His piloting instructor at the flight school said he had usually uttered that phrase at takeoff.[46] His spacecraft control instructor Mark Gallai recalled that the expression was routinely used at the beginning of training sessions on the *Vostok* simulator.[47] Gallai himself had begun using the phrase early in his career as a test pilot. As Gallai noted, Gagarin's use of the phrase reaffirmed his identity as a pilot.

AN INSTRUCTOR'S STORY
Memoirs of Mark Gallai, a spacecraft control instructor

> *Sometimes I deliberately violated the prescribed norms of crew communications. For instance, before the takeoff run, instead of the pompous phrase, "The crew, I am taking off!" most of my colleagues and myself almost always said, "Off we go!" This became common in aviation. Some strict adherents of regulation terminology used to rebuke me for what they saw as a profanation of the elevated language of our noble profession. "What do you mean 'off we go'? Are you a cabby of sorts or a tram driver?"*
>
> *When a pilot addresses the crew, not only the words but also the intonation plays a great part. To reduce the nervous tension on board, the intonation must be calm and measured. . . . As I noticed, "off we go" perfectly relieved the subtle tension that is almost always present before takeoff, especially in experienced crews.*
>
> *Many years later the same expression was suddenly used in a totally different situation. The rocket booster with the first piloted Vostok spacecraft just took off. In the underground control room of the cosmodrome the Chief Designer Sergei Korolev and several other people were present. At that moment, releasing the tension, Gagarin's voice sounded from the speakers: "Off we go!" Our first cosmonaut was above all an aviation pilot.*[48]

The first forty seconds of flight were the most tense, for any emergency required a split-second decision. In the case of rocket failure, Korolev would have to give a verbal order to the operator to activate an emergency system ejecting the cosmonaut from the spacecraft. The cosmonaut would be pulled

away at the safe distance of 120 meters (394 feet) from the rocket, and his personal parachute would deploy at 80–90 meters (262–295 feet) from the ground. The cosmonaut had no control over the ejection, but he could activate the backup parachute, if the main one had failed.[49] The problem was that the risks of parachute jumping so close to the ground were too high. If ejected right on the launch pad, the cosmonaut could land in a giant pit surrounding the launch installation, which would be engulfed in flames from the firing rocket. To avoid this, a metal net was installed over the pit, which would catch the cosmonaut, and a group of rescue workers was on duty to snatch the cosmonaut from the net and to bring him to safety.[50] However, if the rocket lost control and flipped over, the cosmonaut could be ejected downward, toward the ground, without any chance of deploying the parachute.[51] After the fortieth second, an emergency ejection would occur automatically, relieving Korolev of the agony of instant decision making.[52]

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:07–9:08 am

Kedr (Gagarin): The vibrations are becoming more frequent. The noise is somewhat increasing. I'm feeling well. The g-load is increasing further.

Zaria 1 (Korolev): The time is 70 [seconds after the launch].

Kedr (Gagarin): Got it, 70. I'm feeling fine and continue the flight. The g-load is increasing. Everything is all right.

Zaria 1 (Korolev): 100. How are you feeling?

Kedr (Gagarin): I'm feeling well. The vibration and g-load are all right. I continue the flight. Everything is fine.[53]

Korolev felt tense. In the interval between the 40th and the 150th seconds of flight, the rocket was flying too high for an immediate ejection in emergency. In this case, the rocket engines would be cut off, and after the rocket fell down to the altitude of 7 kilometers (4 miles), the cosmonaut would be automatically ejected.[54]

After the 150th second of flight, the rocket nose cone fairing was dropped, and Gagarin for the first time could see the Earth.

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:10–9:11 am

Kedr (Gagarin): The nose cone fairing has been jettisoned. I see the Earth through *Vzor*. The Earth is clearly visible. . . . I see rivers; the surface relief is clearly visible. Visibility is good. It's excellent visibility

through *Vzor*. . . . The g-load and vibration are increasing somewhat. Enduring everything well. I'm feeling fine; the mood is cheerful. I'm observing the Earth through the *Vzor* porthole. I'm discerning the surface relief, snow, woods . . . I'm observing clouds over the Earth, small cumulus clouds, and their shadows. It's beautiful! Beauty![55]

Gagarin enjoyed the breathtaking view, even though he knew that a failed rocket engine could send his spacecraft tumbling down to Earth any second. There was nothing he could do, however; the rescue procedure was fully automatic. Now, as the *Vostok* spacecraft was completely exposed, a different method would be used to save the cosmonaut in emergency: the descent module would separate from the rocket, and the cosmonaut would stay inside his spacecraft until it was time for ejection and parachute landing.[56] But the g-load during an emergency landing could reach an enormous level, twenty-one times the Earth gravity.[57]

A crucial moment came at 9:12 am, when the final, third stage was to boost *Vostok* into orbit. Designed by the chief designer Semen Kosberg, the third stage engine was to fire in the vacuum of outer space, in the conditions that were difficult to test on the ground. Everyone anxiously waited to see if the engine would fire.

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:12 am

Kedr (Gagarin): Kosberg has fired!

Zaria 1 (Korolev): The right thing is working. It's the last step. Everything is normal.[58]

In the heat of the moment, Gagarin slipped and uttered the secret name of the engine designer over the open airwaves. Upon hearing that his engine had fired, Kosberg, a short man, excitedly jumped, as a witness put it, "above his own height." People cheered and called to throw Kosberg into the air.[59] Later on, the transcript and the flight recording were apparently edited, and Gagarin's remark was erased. This alteration was made both in the publicly released version and in the secret transcript sent to the Party authorities. Apparently the leaders of the space program were anxious to hide an occasional slip not only from the public, but—perhaps more importantly—from the country's political leadership.[60]

After the firing of the third stage, Gagarin switched his attention to the observations of the Earth surface. While he talked, Kamanin carefully monitored Gagarin's voice for any sign of mental disturbance.

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:13 am

> **Kedr (Gagarin)**: I'm feeling fine. The flight is proceeding well. I'm observing the Earth through *Vzor*. Visibility is good. One can see and discern everything. Some area is covered with cumulus clouds. We continue the flight. Everything is all right.
>
> **Zaria 1 (Kamanin)**: Good job! You are handling the communications very well. Keep it up![61]

After four minutes of flawless operation of Kosberg's engine came a critical period of 37 seconds during which a failure of this engine could send the spacecraft tumbling into the ocean. Korolev's "fortunate" trajectory led over vast ocean spaces to minimize the possibility of landing on foreign soil. This troubled Kamanin, who feared that rescue ships might come too late.

A GENERAL'S STORY
Lieutenant General Nikolai Kamanin's Diary

> *March 21, 1961. Unfortunately, we know very well that if a spacecraft splashes down into water, it would quickly sink, and radio transmitters would soon stop working because the sphere is not hermetically sealed. Besides, the individual emergency supply kit is not floatable. We have to admit that we are totally unprepared to rescue a cosmonaut from the water, and we need to work more to solve this problem. Let's just hope that the ship lands on the Soviet territory.*[62]

At that moment, the cosmodrome lost its communication link with Gagarin. *Vostok* passed out of range and into the area covered by the Kolpashevo communication station in Siberia.

A GENERAL'S STORY
Lieutenant General Nikolai Kamanin's Diary

> *April 12, 1961. When the communication link was being transferred from the launch site to the Kolpashevo station, we lived through a few very disturbing moments. The cosmonaut didn't hear us, and we didn't hear him. I don't know how I looked at that moment, but Korolev, who was standing next to me, was very anxious. When he took the microphone, his hands trembled, he lost his voice, and his face became distorted and unrecognizable. Everybody sighed with relief, when both Kolpashevo and Moscow reported the restoration of communication with the cosmonaut and the successful reaching of the orbit.*[63]

At 9:18 am, *Vostok* separated from the booster and became a satellite of the Earth. Gagarin could also sigh with relief. Once in orbit, Gagarin not only became the first man in space but was also relatively safe: his spacecraft moved further by inertia and Earth gravity, not by rocket engines. In the first several minutes of flight his heart raced at 140–158 beats per minute.[64] When he finally reached the orbit, the rate dropped to 104.[65] His anxiety gave way to awe and wonder. The first person to observe the Earth from outer space, the usually calm and composed Gagarin turned euphoric.

COMMUNICATIONS TRANSCRIPT
Gagarin's communications with Ground Control, 9:26–9:27 am, 10:06 am

> **Kedr (Gagarin)**: It's good! Beauty! . . . The feeling of weightlessness is interesting. Everything is floating. Beauty! Interesting!
>
> The flight is going wonderfully. The feeling of weightlessness is all right. I'm feeling well. All the equipment, all the systems are working well.
>
> The surface of the Earth is visible through a porthole. The sky is black. Around the edge of the Earth, around the edge of the horizon is such a beautiful blue halo, which darkens farther from the Earth.
>
> I'm seeing the Earth horizon—a very beautiful halo. First, a rainbow rises up from the Earth surface and goes up and down. Very beautiful! It's all visible through the right porthole. I see stars through *Vzor*, how the stars are passing. A very beautiful spectacle! The flight continues in the Earth shadow. Right now I'm observing a star through the right porthole. It's moving from left to right across the porthole. The star has gone to the right. It's going, going.[66]

With all the excitement, Gagarin did not lose sight of his precarious situation. In between his ecstatic exclamations, he repeatedly asked the ground, in a sober tone, for his orbital data. The exact parameters of the orbit were crucial in one sense: if the retrorocket malfunctioned and did not slow down *Vostok* for planned descent, Gagarin could count only on the natural decay of his orbit due to air resistance in the upper atmosphere. Precisely for this contingency, the planned *Vostok* orbit was low, 180–230 kilometers (112–143 miles). From such an orbit, the spaceship was expected to descend and land on its own within seven days, even if retrofire failed.[67]

The computation center of the Scientific Research Institute No. 4, the ballistics research center of the Ministry of Defense, was charged with the task of determining the actual parameters of the *Vostok* orbit within a few minutes after it reached the orbit. As the spacecraft was being tracked by ground stations, data were transmitted to the computation center, encoded on punch cards, and fed into two giant vacuum tube M-20 computers, the top of the

line Soviet computer technology at the time. Within a few minutes, the orbital parameters were calculated and transmitted to the command-and-control station and to Korolev at the cosmodrome.[68] The calculations were rushed to make it possible to broadcast an official TASS announcement as soon as possible and also to inform the cosmonaut while he was flying over the Elizovo station in the Far East, the last shortwave station on Soviet territory.

Even with a rough estimate, it was clear that *Vostok* was boosted to a much higher orbit than planned. As it later turned out, because of a power supply failure, a ground command station did not transmit a radio signal to shut down the central section engines of the rocket. The engines were eventually shut down by a backup signal from the onboard acceleration sensors. This tipped the balance in the long-term dispute between the supporters of radio control from the ground and the champions of autonomous onboard control systems. In future human flights, Korolev decided to rely on onboard systems for controlling rocket engines.[69] In Gagarin's flight, the onboard acceleration sensors did not work perfectly either. Their actual margin of error proved six times larger than specified, and the central section engines were shut down somewhat later than needed, boosting *Vostok* to a dangerously high orbit. A quick estimate of the actual orbit gave the apogee of 302 kilometers (188 miles). Some of Korolev's close associates guessed that natural orbital decay from such a high altitude could take fifteen to twenty days.[70] *Vostok* had a supply of oxygen, food, and water for only ten days.

Korolev did not permit the transmission of orbital data to the cosmonaut. The public announcement was also delayed. At 9:26 am, in response to Gagarin's inquiries, a ground operator at Elizovo could only say, "no directives from Number 20 [Korolev's call sign]; the flight is proceeding normally."[71] For almost half an hour, Gagarin had no information about his orbit. At 9:53 am, on Kamanin's orders, another operator gave Gagarin false assurances, "The flight is proceeding normally; the orbit accords with calculations."[72]

At 10:02 am the TASS news agency finally made its famous announcement of the first human flight into outer space.

THE OFFICIAL STORY

Soviet news agency TASS communiqué, April 12, 1961, 10:02 am

> The Soviet Union has successfully launched a manned spaceship-satellite into an orbit around the Earth. Present aboard the spaceship is the pilot cosmonaut, Yuri Alekseevich Gagarin, an Air Force pilot, 27 years of age. . . . The orbital period is 89.01 min, the perigee is 188 km [117 miles], the apogee is 302 km [188 miles] . . . . At 9:52 a.m., Moscow time, Major Yuri Gagarin reported that he was over South America and that he was in excellent spirits.[73]

The whole world heard the preliminary estimate of Gagarin's orbit, 188–302 kilometers, but the cosmonaut himself was not aware of it and continued to believe that his orbit was close to the planned range of 180–230 kilometers. In the meantime, back at Korolev's design bureau, his ballistics team was frantically calculating Gagarin's chances in case of retrorocket failure.

A MATHEMATICIAN'S STORY
Interview with Sviatoslav Lavrov, head of the ballistic department at the Special Design Bureau No. 1

> *The task was to determine the time period of natural orbital decay for the actual trajectory. This was right down my alley. I rushed to the ballistics department to use the tables kept there. It turned out that the time for slowing down in the atmosphere would fit into that [ten-day] interval, though close to the limit. Atmospheric parameters are quite unpredictable and prone to large variations, especially at such altitudes. When I came back to our group with this half-good news, I found everyone rejoicing: the retrorocket did fire.*[74]

More precise calculations after the flight showed that the actual apogee of the *Vostok* orbit was 327 kilometers (203 miles), even higher than was thought at the time.[75] If retrofire had failed, Gagarin would have been in grave danger.

A COSMONAUT'S STORY
Gagarin's report to the State Commission, April 13, 1961

> *The retrorocket fired for exactly forty seconds. During that period, the following occurred,* **apparently unexpected**. *As soon as the retrorocket shut off, there was a sharp jolt, and the craft began to rotate around its axis at a very high velocity. The Earth passed in Vzor from top right to bottom left. The rate of rotation was at least 30 degrees per second. It was like the "corps de ballet": head, then feet, head, then feet, all rotating rapidly. Everything was spinning around. Now I see Africa (this happened over Africa), next the horizon, then the sky. I had barely enough time to cover myself to protect my eyes from the Sun's rays. I put my legs to the porthole, but didn't close the blinds. I was interested to see what was going on.*[76]

The words "apparently unexpected" were deleted from the secret transcript of Gagarin's report submitted to the country's political leadership. The management of the space program did not seem interested in drawing the attention of their bosses to various technical glitches. The public did not see the report at all.

Moreover, a classified postflight report, prepared by the engineers in May

1961, quietly reduced the rotation speed to six degrees per second.[77] The engineers thus implied that the spacecraft made one full turn per minute, which squares poorly with Gagarin's perception of "corps de ballet."

Initially Korolev's engineers decided that the rotation was caused by a stuck throttle that regulated pitch.[78] Later, another version emerged: a malfunctioning valve in the fueling system caused the retrorocket to shut off prematurely and erroneously let fuel into the spacecraft's maneuvering jets.

AN ENGINEER'S STORY
Analysis by German Formin, an engineer at the Special Design Bureau No. 1

> *For 1–2 seconds, the retrorocket worked normally. When the pressure in the combustion chamber reached the nominal level, the OKNK valve should have closed. But this did not happen; the valve did not fully close and thus failed to provide a hermetic seal. . . . As a result, there was not enough fuel to complete the nominal burn, and the engine shut off because it ran out of fuel after 40.1 seconds, that is, 0.5–1 seconds before the main command to shut off the engine could be generated. After the spontaneous engine shutoff, the main command to shut off the engine did not go through. . . . Through open lines, fuel and oxydizer continued to flow into the combustion chamber and into the maneuvering jets spontaneously and uncontrollably. . . . A powerful disturbance affected the spacecraft and led to its rotation around the center of mass with the rate of 30 degrees per second.*[79]

The annoying rotation was expected soon to end: within a minute Gagarin's descent module was to separate from the instrument compartment that contained the jets.[80] But the separation did not occur. The two sections of the spacecraft were still attached to each other and continued to spin wildly. This posed a serious danger. Only one side of the descent module had thick thermal coating to protect it from the intense heat on reentry. It was essential to separate and stabilize the descent module in order to meet the wave of heat with this protected side. The spinning *Vostok* was quickly approaching the denser part of the atmosphere in which heat would start burning through the coating. According to *Vostok* specifications, engineers regarded this type of emergency as one in which "rescuing the pilot is practically impossible."[81]

A COSMONAUT'S STORY
Gagarin's report to the State Commission, April 13, 1961

> *I waited for the separation [of the descent module from the instrument section]. There was no separation. I knew it was scheduled in 10 to 12 seconds after the retrorocket shutoff. I felt that more time had passed, but there was*

no separation. . . . The "corps de ballet" continued. I decided that something was wrong. I checked the time on the watch. About two minutes had passed but there was no separation. I reported over the shortwave channel that the retrorocket had worked normally. I estimated that I would be able to land all right anyway, because the distance to the Soviet Union was 6,000 km [3,700 miles], and the Soviet Union was about 8,000 km [4,900 miles] long. That meant that I could land somewhere before reaching the Soviet Far East. So I decided not to make a fuss about that. Over the telephone, I reported that the retrorocket had worked normally . . . and also reported that the separation did not occur. It seemed to me that this was not an emergency. I used the telegraph key to transmit the "VN" message meaning "everything normal."[82]

Gagarin had no manual control over the separation procedure, and he had to rely completely on automatics. He knew that the system had a backup: a set of thermal sensors on the instrument section would give a signal for separation when the spacecraft heated up on reentry. This backup option had been put in for emergency descent in case the booster failed shortly before reaching the orbit.[83] The separation finally occurred at 10:36 am, a full nine minutes after the scheduled time.

Engineers at Korolev's bureau still cannot agree on the exact sequence of events. A postflight report issued in May 1961 stated that the descent module was apparently separated "by the emergency separation system [after a signal] from the thermal sensors."[84] Some still support this version, arguing that since the retrorocket shutoff command was not generated, the whole descent sequence was aborted, and the separation command was not issued either. A backup signal for separation was generated nine minutes later by the thermal sensors. This explanation has one flaw: the separation occurred at the altitude of 148–170 kilometers (92–106 miles), while the thermal sensors' signal was supposed to kick in at much lower altitudes, 100–110 kilometers (62–68 miles).[85] Other engineers insist that the nine-minute gap between the retrorocket shutoff and the separation was part of a regular command sequence, and that the signal came from an internal timing device according to schedule, not from the thermal sensors. Gagarin's confusion is explained away by his "use of mechanical clock" and "agitated condition."[86] This delay, however, came as a surprise not only to Gagarin but to Korolev himself, who wrote in his notebook, while listening to Gagarin's report, "the separation occurred at 10:25:57 (planned), 10:35 (actual), what's the matter?"[87] While disagreeing on technical issues, engineers unanimously deny that any emergency took place. The 1996 official history of Korolev's design bureau still insists that Gagarin made a mistake in his postflight report.[88]

At the altitude of 7 kilometers (4 miles) Gagarin's seat was to be automatically ejected from the spacecraft and to continue descent on a stabilizing parachute. The decision to use a personal parachute instead of landing inside the spacecraft was a forced one. Korolev's engineers estimated that a soft landing of the entire descent module would require very large parachutes, which they could not afford under the strict weight limits. Designing and testing special soft landing engines would take too much time, and Korolev was in a hurry. Such engines would be created only three years later for the *Voskhod* multicrew spacecraft. Some engineers also feared that heat on reentry might melt the hatch edges, and the cosmonaut would not be able to open it himself. Before the rescue team arrived, the cosmonaut could die from overheating.[89] With no time to conduct new tests, Korolev decided to use the already tested emergency ejection procedure as a means for regular landing. To rescue the cosmonaut in the first phase of the flight in case of emergency, the engineers had designed an ejection seat and a personal parachute. The same procedure was now planned for the final phase of descent and landing. Feoktistov explained, "It may seem strange, but we adopted this apparently complicated solution for greater reliability."[90]

The ejection hatch blew off, Gagarin's seat was successfully ejected, and the cosmonaut and his spacecraft were now descending on two separate parachutes. At the altitude of 4 kilometers (2.5 miles) Gagarin was automatically detached from his seat, and his main personal parachute was deployed.

In the last few minutes of flight, Gagarin was finally to play an active role—to control his own parachute descent. "When the parachute deployed above me, and I felt the firmness of shroud lines, I began to sing,"[91] he told an interviewer later. In fact, he was in no mood for singing. He was descending backward, facing the wind, and could not control the parachute. And then automation brought him another surprise.

A COSMONAUT'S STORY
Gagarin's report to the State Commission, April 13, 1961

> *I began descending on the main parachute. I was carried toward the Volga again. During parachute training, we had jumped many times over this very spot. . . . Then the backup chute deployed; it pulled out and hung down. It did not fully open. Only the container opened. . . . Then I passed through a layer of clouds. It got a bit windy in the clouds, and the second parachute fully opened. I continued descent on two parachutes at once.*[92]

Apparently automation malfunctioned again, and a backup was deployed alongside the main parachute, threatening to entangle the lines of the main parachute. It was precisely against this contingency that Gagarin and other

cosmonauts had warned Kamanin just a few days earlier. At that time, Kamanin dismissed it and even concluded that Gagarin was talking too much. After the flight, Kamanin realized the potential threat. He began to view the automatic deployment of the backup parachute as a serious shortcoming of the landing system. The engineers had a different view and did not make any changes.[93]

In the postflight report, the engineers admitted that both parachutes were deployed but did not regard this as equipment malfunction. Instead, they explained Gagarin's inability to control his descent by "the pilot's constrained motion in a spacesuit" and "the insufficient training of pilots."[94] Through creative technical analysis, the blame was shifted from the engineers to the cosmonaut.

While struggling with the two parachutes, Gagarin also feared that he might splash into the Volga River, which was particularly wide in that area. His emergency supply kit was tethered to his body, and it could drag him to the bottom. Gagarin cut off the connecting line, and the supply kit disappeared, and with it vanished the equipment that registered Gagarin's physiological functions during the flight.[95]

Most important, the supply kit also contained the radio beacons that directed the search and rescue team. Without these beacons, the team did not know where Gagarin was; they were able to follow only the descent module, which could land miles away. The rescue team was stationed at the Kriazh airfield near Kuibyshev (now Samara), not far from the originally planned landing site.[96] When ballistics specialists received the actual orbital data, they recalculated the landing site and pointed to a spot 110 kilometers (68 miles) from the city of Stalingrad (now Volgograd). The rescuers rushed to the new location.[97] In fact, Gagarin was descending somewhere in between, in the Saratov region, some 180 kilometers (112 miles) from the planned landing site.[98] Without the radio beacons, he was on his own; in case of emergency landing he could count only on himself or the locals.

While still in the air, Gagarin faced another problem. He tried to open the respiration valve on his helmet and discovered that it was stuck under the bright orange covering of his space suit. Straps blocked his access to the valve, and it took him about six minutes to unzip the covering and release the valve. Gagarin was able to open his helmet only on the ground. At last, he could breathe freely.

SOVIET NEWSPAPER CLIPPINGS, APRIL 14–15, 1961

Eyewitness report

> *The cosmonaut landed on a parachute not far from us. He controlled the parachute by pulling on some shroud lines, then on others.*[99]

Eyewitness report

A man on a large white-and-red parachute flew over us and landed just a few steps away. I was taken aback at first, but the man in red quickly rose up and in a friendly manner called us to come closer. He said, "I'm Russian, Soviet!"[100]

Newspaper editors were apparently unaware that Gagarin's landing on a parachute was supposed to be a big secret. The Soviet authorities intended to register a number of world records set during Gagarin's flight with the Fédération Aéronautique Internationale (FAI). But there was a hitch: the FAI would certify a record only if the pilot took off and landed in the same vehicle; other scenarios were viewed as emergency landing. At the April 8 meeting of the Launch Commission, a heated debate broke out whether to submit an application for flight records to the FAI. The commander of the Strategic Missile Forces marshal Moskalenko objected to disclosing any information about the rocket and the launch site, the Tyuratam cosmodrome, which was routinely used for test launches of combat missiles. Korolev and Kamanin, however, insisted on publicizing the flight, and the Commission chairman Rudnev gave in. It was decided, in case of a successful flight, to submit certification documents to the FAI excluding the classified information.[101]

After the flight, the Soviet authorities filed official paperwork with the FAI, claiming three world records for the *Vostok* flight: flight duration (108 minutes), altitude in elliptical orbit (327 kilometers [203 miles]), and greatest mass lifted to altitude (4,725 kilograms [10, 417 pounds]). To hide the location of the Tyuratam cosmodrome, a false set of coordinates of the launch site was given. Ballistics specialists at the Scientific Research Institute No. 4 chose a small town of Baikonur over 300 kilometers (186 miles) southeast from the cosmodrome as "the most natural" candidate for a fake launch site.[102] The records file submitted to the FAI also claimed that Gagarin landed inside the *Vostok* descent module, even though the capsule landed on its own parachute a few kilometers from Gagarin's landing site.

THE OFFICIAL STORY

"Records File on the First Space Flight by the USSR Citizen Yuri Alexeyevich Gagarin," submitted to the Fédération Aéronautique Internationale

Statement of landing of VOSTOK spaceship

On the 12th ofApril, 1961, I, the undersigned, Ivan Grigorievich Borisenko, sports commissar of the USSR Tchkalov Central Aeroclub, bear witness to the fact that at 10.55 a.m. Moscow time on the 12th of April, 1961, in the vicinity of the village of Smelovka, Ternovka district,

Saratov region, the USSR, the pilot-cosmonaut Yuri Alexeyevich Gagarin landed with the "Vostok" spaceship which had the identifying marks of "USSR–Vostok."[103]

Three months later, on July 18, 1961, the FAI certified Gagarin's records, despite widely expressed doubts about the truthfulness of the official story.[104] The suspicions were fueled by published eyewitness reports, as well as by Gagarin's own words, "I felt the firmness of shroud lines, I began to sing," published in a newspaper interview on April 15.[105] The same day, Gagarin was asked at a press conference about his landing. "The pilot remained inside the cabin," he insisted.[106] Later on, while speaking in public, Gagarin tried not to lie explicitly about his landing, nor did he tell the truth. He carefully avoided the subject altogether. The fact that Gagarin landed on a personal parachute separately from the descent module was kept secret for ten years.[107]

The astronomer Alla Masevich, who vetted Soviet space-related publications, apparently had not been in the loop about the landing issue, and she authorized the publication of revealing newspaper reports. She was relieved of her censoring duties, and deputy director of the Scientific Research Institute No. 4 Mozzhorin was charged with the task of monitoring press reports to ensure no further leaks.[108] Soon Mozzhorin was appointed director of the Scientific Research Institute No. 88, and the censorship of space reports became one of the Institute's official functions.

On the next day after landing Gagarin gave a secret report before the State Commission and answered questions from engineers, physicians, and other specialists. The main issue was his mental and physiological condition and working capacity. Gagarin realized that every small action he performed in orbit was a test for a whole range of future activities. By proving his ability to perform various operations, Gagarin was opening the door for longer spaceflights in the future.

A COSMONAUT'S STORY

Gagarin's report to the State Commission, April 13, 1961

I made reports according to the assignment in the telegraph and telephone modes. I took water and food. I ate and drank normally. It is possible to eat and drink. I felt no physiological difficulties. The feeling of weightlessness was somewhat unfamiliar compared with Earth conditions. Here, you feel as if you were hanging in a horizontal position on straps, as if suspended. Apparently, the tightly fitted suspension system presses upon the thorax, and the impression of hanging is created. I quickly got used to it and adapted. There were no unpleasant sensations.

I made entries into the logbook, reported, and worked with the telegraph key. When I was having food and drinking water, I released the writing pad, and it "floated" in front of me together with a pencil. Then I needed to write down another report. I took the pad, but the pencil was gone. It had flown off somewhere. A hook had been attached to the pencil with a screw; it should have been glued or tightened. The screw fell off, and the pencil flew away. I closed up my logbook and put it in my pocket. It was of no use; I had nothing to write with anyway.[109]

Gagarin stood before the members of the State Commission perfectly healthy, a living testimony to the possibility of human presence on board an orbital spaceship. His mission as defined in the *Vostok* assignment was accomplished. Yet Gagarin tried to prove that he could do more, that more complex tasks, such as active piloting, were feasible.

A COSMONAUT'S STORY

Gagarin's answers to questions at the State Commission meeting, April 13, 1961

Question: *Based on your experience with the prolonged impact of weightlessness on the organism, do you believe that a cosmonaut who never flew into orbit, who did not have this experience, could be in the state of weightlessness a longer time?*

Answer: *I think, based on my own sensations, a flight in the state of weightlessness could be longer, but the human must be busy during the flight, must do active work. The suspension system must leave more freedom, so that the human would not have the sensation that he is hanging on straps all the time. A human, I think, can stay [in orbit] a long time. It seems to me, it's possible to stay for twenty-four hours.*

Question: *A question about manual control. As a pilot-cosmonaut, what is your assessment: could you perform manual control? I don't mean the moral readiness, but the readiness of equipment.*

Answer: *I believe I could handle manual control and perform descent. Why? My physical condition was very good, reactions good, the work capacity of the body at that time was also good, the onboard control equipment functioned well, all circuits were well tested and worked well during control operations, and attitude control could be performed with Vzor. I believe attitude control could be performed very reliably. I said in the report that attitude control could be performed both over sea and over land. Even in my field of vision, when a distorted horizon enters the outer ring of Vzor, I could see well. One could orient the ship by observing the direction of movement of Earth landmarks in the Vzor system.*[110]

A transcript of Gagarin's postflight report, along with a transcript of flight communications, was sent to the Party Central Committee. The leadership of the space program, however, carefully controlled the information they shared with the Party authorities. Several of Gagarin's remarks about protocol violations and various technical glitches were removed from the postflight report.

A COSMONAUT'S STORY

Excerpts from Gagarin's report to the State Commission deleted from the official transcript, April 13, 1961

> *We left the bus. Then I got confused a bit and reported to Sergei Pavlovich [Korolev] and to the marshal of the Soviet Union [Moskalenko] instead of reporting to the chairman of the State Commission [Rudnev]. I just got confused at that moment. I apologize for this blunder. It was embarrassing. . . .*
>
> *During the communication check [at the launch pad] there was a little snag. At first, they did not hear me. I heard them well. At first they did not hear me; then they began to hear well. Next, when they broadcasted music over the shortwave channel, this music began to drown out the UHF channel. I asked to turn the music off. Later on, when they turned it on, everything worked fine. . . .*
>
> *The space suit is very uncomfortable. It is firmly tied to the back of the seat, and it is not convenient to make observations.*[111]

The next day Gagarin flew to Moscow to a hero's welcome, officially reported to Khrushchev at Vnukovo Airport, and delivered a speech before a tremendous crowd at Red Square. For his flight, Gagarin received the title of Hero of the Soviet Union, the promotion to the rank of major (skipping the rank of captain), the title of military pilot First Class (skipping Second Class), a personal car, and worldwide fame.

Nearly seven thousand engineers, scientists, and technicians who contributed to the *Vostok* flight received various titles, medals, bonuses, and lifetime anonymity. At a closed unpublicized ceremony Korolev received the Order of Lenin and the title of Hero of Socialist Labor. Most important, he received an opportunity to advance his ambitious plans of space exploration. The unbelievable gamble of Gagarin's flight paid off.

Sergei Darevskii, the chief designer of spacecraft control panels, once complained to Korolev that his superiors dismissed his space projects as "adventurism." "Do you know the difference between reasonable risk taking and reckless adventurism?" asked Korolev. "If you pull it off, it's a reasonable risk, and if you don't, it's adventurism."[112]

The history of Gagarin's flight was written just as Korolev anticipated: it became a success story, and all the details that complicated the picture were

simply purged from the record. Censorship experts at the Scientific Research Institute No. 88 duly screened every publication, weeding out any disclosure of technical failures or social tensions within the space program. In the official version, Gagarin's flight had no glitches at all, except for the little snag with the improperly closed hatch at the launch pad, quickly fixed. The envelopes with alternative versions of the TASS announcement for the less fortunate outcome of the *Vostok* flight, still sealed, were collected from the radio and television stations and destroyed.[113] Kamanin published a sanitized version of Gagarin's flight communication transcript; the version sent to the Party leadership was similarly edited.[114] These edits were not made by Soviet ideologues trying to deceive the world for propaganda purposes; it was the management of the space program who attempted to hide occasional errors from the Soviet leadership. Self-censorship became so ingrained that an explicit prohibition or command was no longer necessary. The Soviet leaders received information already edited according to the expected ideological standards. They then added their own reasons to deceive the world, further contributing to myth making.

Although secrecy considerations initially prevailed over propaganda needs, later propaganda took an upper hand. As the design of *Vostok* was practically identical to the automatic reconnaissance satellite *Zenit-2*, the Soviets kept it secret for several years. This gave rise to much speculation in the West about the shape and interior of *Vostok*. The Soviet leadership, pressured by space designers, eventually agreed to lift a corner of the veil of secrecy over the space program. A *Vostok* mock-up was put on display at the Exhibit of the Achievements of the National Economy in Moscow in April 1965.[115]

Gagarin became a public icon; endless hagiographic writings extolled the superhuman virtues of the space hero, who, in his own eyes, was "an ordinary man." The ceaseless repetition of the proud title of "pilot-cosmonaut" stirred Gagarin's bitter memories: despite his best hopes, he was not allowed to pilot his spacecraft. But the fight over cosmonaut identity—the competition between the human and the machine for the control of spacecraft—was only beginning. In the flights that followed, the struggle was renewed with even greater intensity.

5 HUMAN-MACHINE ISSUES, THE COSMONAUT PROFESSION, AND COMPETING VISIONS OF SPACEFLIGHT

IN December 1968, Lieutenant General Kamanin wrote an article for the *Red Star*, the Soviet Armed Forces newspaper, about the forthcoming launch of *Apollo 8*. He entitled his article "Unjustified Risk" and said all the right things that Soviet propaganda norms prescribed in this case. But he also kept a private diary. In that diary, he confessed what he could not say in an open publication. "Why are the Americans attempting a circumlunar flight before we did?" he asked. Part of his private answer was that Soviet spacecraft designers overautomated their spacecraft and relegated the cosmonaut to the role of a monitor, if not a mere passenger. The attempts to create a fully automatic control system for the *Soyuz* spacecraft, he believed, critically delayed its development. "We have fallen behind the United States by two or three years," he wrote in the diary. "We could have been first on the Moon."[1]

Kamanin's criticism was shared by many in the cosmonaut corps who described the Soviet approach to the division of function between human and machine as "the domination of automata."[2] A different view prevailed among the spacecraft designers. They regarded the high degree of automation on Soviet spacecraft as a remarkable achievement. The leading control system designer Boris Chertok, for example, praised the implementation of "the absolute requirement for automatic rendezvous and final approach" on *Soyuz*, in contrast to the human-mediated rendezvous procedure on *Apollo*. "We did

not copy the Americans," he argued, "and this would prove to be a future strong point of our cosmonautics."[3]

The historiography of the Soviet space program has devoted little attention to onboard automation, treating it largely as a narrow technical issue. Yet the intensity of Soviet debates over the division of control functions between human and machine, both in the design phase and during spaceflights, indicates that the issue has fundamental importance. The success or failure of specific missions often depended on crucial control decisions made by the crew, onboard automatics, or ground control. The correctness and timeliness of such decisions critically hinged upon the integration of human decision makers into a large, complex technological system.

Historians and sociologists of technology have long stressed the crucial role of users in shaping technological systems. Recent scholarship on the "co-construction" of users and technology emphasizes how users define, modify, redesign, and resist new technologies, as well as exploring the effects of technology on the definition and transformation of the user.[4] In case of cosmonautics, the users—the cosmonauts and the ground controllers—were in effect critical links in the operation of a large technological system; they were being "used" as much as they were "using" the system themselves. Space engineers' efforts to design spacecraft and control systems included detailed specifications for the human input in the system. The debates over automation thus touched the very core of the cosmonauts' professional identity. Were they self-governing users in charge of their spacecraft, or just "human links" in the system?

The very definition of the cosmonaut profession depended on the degree of onboard automation. What was the relative importance of cosmonauts' skills as pilots, engineers, or researchers? Did cosmonaut pilots need technical expertise? Did flight engineers have to know how to pilot a spacecraft? Technological choices, professional identity, and the social status of cosmonauts proved intimately intertwined.

The seemingly technical problem of onboard automation also raised larger questions of the nature and purpose of human spaceflight. Competing visions of human spaceflight as a piloting mission, an engineering task, or a research enterprise, advanced by different groups within the space program, relied critically on varying opinions about the feasibility and suitability of automation.

The problem of onboard automation, over which the interests of different professional groups clashed, provides a window into the internal politics of the Soviet space program. Most recent scholarship on Soviet space history—from biographies to institutional histories to policy analysis—has tended to focus on only one of the relevant groups—the cosmonauts, the engineers, or the policy-making community. A study of human-machine issues illuminates

the roles of all major professional groups within the Soviet space program. Aviation designers, rocket engineers, human engineering specialists, and cosmonauts had very different assumptions about the role of the human on board a spacecraft. A study of the actual division of function between human and machine on board would help us understand the role of these groups in shaping the Soviet space program.

Comparative studies of the American and Soviet aerospace industries have addressed the role of the national context in space engineering.[5] Soviet space program participants often regarded the United States as the paragon of a "human-centered" approach to spacecraft design. A closer look at the two space programs through the prism of onboard automation reveals a more complex picture. By exploring the arguments of internal debates, the diversity of engineering cultures, and the negotiations among various groups favoring different approaches to automation, one could critically reexamine the stereotype of fixed "national styles" in space engineering.

The problem of onboard automation was not a purely technical issue but also a political issue—not in terms of big politics but in terms of "small" local politics. This chapter examines how technological choices were shaped by power relations, institutional cultures, and informal decision-making mechanisms, and how these choices, in turn, had significant ramifications for the direction of the Soviet space program and ultimately not only defined the functions of machines but also molded the professional identities of cosmonauts.

The chapter looks at several phases in the Soviet space program from the early 1960s to the late 1970s. It argues that the Soviet approach to the problem of onboard automation was neither fixed nor predetermined; rather, it evolved over time and diversified across different institutions and projects. Instead of a single, dominating approach, we find a series of debates, negotiations, and compromises. The division of function between human and machine on board had much to do with the division of power on the ground among different groups involved in the debates over automation. These episodes can be taken as entry points into larger historical issues about politics, organization, and culture beyond the Soviet space enterprise.

AUTOMATION ON *VOSTOK*: TECHNOLOGICAL, DISCIPLINARY, AND MEDICAL FACTORS

The first piloted spacecraft—the Soviet *Vostok* and the American *Mercury*—were both fully automated and flight-tested initially in the unpiloted mode. There was, however, one important difference: the astronaut on board had a wider range of manual control functions than the cosmonaut. There were only two manual control functions that a cosmonaut could perform in case of emergency: orienting the spacecraft into correct attitude and firing the retrorocket for descent.[6] The range of manual control functions available to and actually

performed by American astronauts was much wider. They could override the automatic system in such essential tasks as separating the spacecraft from the booster, activating the emergency rescue system, releasing the parachute, dropping the main parachute in case of failure and activating the second parachute, correcting the onboard control system, and many other functions unavailable to Soviet cosmonauts.[7] The difference can be illustrated by a simple comparison of the control panels of *Vostok* and *Mercury*. The *Vostok* panel had four switches and thirty-five indicators, while the *Mercury* instrument panel had fifty-six switches and seventy-six indicators.[8] This trend continued with subsequent generations of spacecraft. *Gemini* had 150 switches and indicators, while *Apollo* featured as many as 448. As historian David Mindell has noted, "Much of the crew's efforts would resemble operating a telephone switchboard as they flipped switches and actuated valves to configure the spacecraft for various phases of flight."[9]

Different authors have offered a number of explanations for the Soviet reliance on automation in the case of *Vostok*:

1. *High reliability of automatic control*: Soviet rockets could lift greater weights, and therefore the Soviets could install redundant sets of automatic equipment to ensure its reliability.
2. *Disciplinary bias of rocket engineers*: Unlike American space engineers, who came from the aviation industry, Soviet spacecraft designers drew on specific engineering traditions in rocketry, and they were not accustomed to assign humans a significant role on board.
3. *Health and safety concerns*: Doubts existed about the cosmonaut's mental and physical capacity to operate the spacecraft in orbit.

Some of these explanations do have a grain of truth. Yet they mostly reflect partisan positions in internal Soviet debates over the proper division of control functions between human and machine.

The first "technological" explanation is most favored by spacecraft designers, who view it as an "objective" basis for automation. Indeed, the *Vostok* rocket could lift to the orbit a 4.5-ton spacecraft, while the Americans could launch only 1.3 to 1.8 tons. Using this extra weight, the argument goes, the Soviets could afford to build redundant, more reliable systems and to construct a fully automatic spacecraft, while the Americans were forced to delegate some of the functions to the astronaut on board. The space journalist Iaroslav Golovanov wrote: "The American astronaut had to work more than the Soviet cosmonaut because the weight of *Vostok* was more than twice the weight of *Mercury*, and this made it possible to relieve [the cosmonaut] of many in-flight tasks."[10]

Interestingly, this argument only suggests an explanation for the need for a broad range of manual control functions on *Mercury*, while the Soviet preference for complete automation is assumed as a natural solution. Those who used this argument clearly took it for granted that automatic systems were inherently more reliable than human control. In fact, it is by no means obvious why one should use weight reserves to install redundant sets of automatic equipment instead of building a more flexible and sophisticated manual control system. Soviet space designers admitted that the onboard equipment they were supplied with was so unreliable that installing extra sets was the only way to ensure an acceptable risk of failure. Chertok acknowledged that the Americans were able to make a much better use of their weight reserves than the Soviets. *Gemini* weighed only 3.8 metric tons, while *Vostok* weighed almost a ton more, and *Voskhod 2* almost 2 tons more than *Gemini*. Yet, Chertok remarked, "the Gemini outperformed the Vostoks and Voskhods across the board."[11] *Gemini* had a rendezvous radar, an inertial guidance system with a digital computer, a set of fuel cells with a water regenerator, and many other types of onboard equipment that the first Soviet spacecraft lacked.

The second "disciplinary" explanation is often put forward by cosmonauts, who tend to blame the "overautomation" of Soviet spacecraft on the professional background of rocket engineers. According to the space historian and former cosmonaut candidate Ponomareva, "In the United States space technology developed on the basis of aviation, and its traditional attitude toward the pilot was transferred to space technology. In the Soviet Union the base for the space enterprise was artillery and rocketry. Rocketry specialists never dealt with a 'human on board'; they were more familiar with the concept of automatic control."[12] This argument assumes that the Soviet space program was a culturally homogeneous assembly of rocket engineers. In fact, *Vostok*'s chief designer Korolev had come into rocketry from aeronautics; in the 1920s and 1930s, he had designed and tested gliders.[13] Two of his deputies, leading spacecraft designers Pavel Tsybin and Sergei Okhapkin, had previously been prominent aircraft designers. Heated debates over the division of function between human and machine often broke out within the space engineering community, and the opponents in those disputes were not necessarily divided along the lines of their disciplinary background. For example, in July 1963—when the leadership of Korolev's design bureau discussed various options for lunar exploration—it was Tsybin who advocated the use of automatic spacecraft, and it was the rocket designer Mikhail Tikhonravov who insisted on the development of piloted spaceships.[14] Tikhonravov also argued in favor of making *Vostok* controls completely manual.[15]

In private, Soviet cosmonauts with aircraft piloting background tended to blame rocket engineers, nicknamed "artillerymen," for any design flaws.

For example, during her training as a cosmonaut, Ponomareva noticed that yaw and roll in the hand controller on the *Vostok* spacecraft were rearranged as compared to a typical aircraft hand controller. Fellow cosmonauts told her that it was "because artillerymen made it."[16] As it turned out, the controller was developed by specialists from the Air Force Flight Research Institute, which specialized in aviation control equipment. Yaw and roll were rearranged because the controller itself was positioned differently, which, in turn, was the result of a different position of the cosmonaut as compared to the aircraft pilot. Moreover, because spacecraft could rotate in all directions, yaw and roll in some cases simply changed places. There was no artillerymen conspiracy; it was aviation specialists who designed manual control and information display equipment for Soviet spacecraft.[17]

The third "medical" explanation often cites Soviet doctors' concern that the cosmonaut's mental and physical capacities might be impaired during the flight.[18] In fact, although doctors did study the issue of the cosmonaut's health and working capacity in orbit, they were not pushing for automation. It was the leading engineers who insisted, for example, that Yuri Gagarin should not actively control his spacecraft during the first human flight but should only monitor the work of automatic systems. They believed that in a short, single-orbit flight the automatics would work perfectly.[19] The chief physician Vladimir Iazdovskii, by contrast, was in favor of expanding the range of Gagarin's tasks. Doctors argued that keeping the cosmonaut constantly busy would help him avoid negative emotions during the periods of g-loads and weightlessness. The latter view prevailed and Gagarin was instructed to check onboard equipment before launch, to write down his observations and instrument readings during the flight, and to report this information over the radio. The cautious engineers, however, took technological measures to ensure that an agitated cosmonaut would not mess up with their automatics. They installed a digital lock, blocking the manual orientation system for reentry. The combination was placed on board in a sealed envelope, which the cosmonaut was allowed to open only in an emergency.[20]

None of the three popular explanations—the reliability of redundant automatics, the disciplinary bias of rocket engineers, and the uncertainty about human performance in orbit—provides an unequivocal argument in favor of automation. All three aspects of the problem of automation—technological, disciplinary, and medical—involved debates and negotiations whose outcome was not predetermined from the very beginning.

VOSTOK DUAL USE: MILITARY/CIVILIAN AND AUTOMATIC/MANUAL

Recently published materials suggest another explanation for the Soviet reliance on automation in the design of *Vostok*, an explanation that empha-

sizes the social shaping of technology. It suggests that the military context played a decisive role in defining civilian technologies in the Soviet space program.

Vostok was designed at the Special Design Bureau No. 1 as an add-on to its main specialty, ballistic missiles. Trying to win support of the military, the designers of *Vostok* effectively disguised a piloted spacecraft as an automatic reconnaissance satellite. In September 1958, Korolev submitted to the government an official proposal to develop two projects—an automatic reconnaissance satellite and a piloted reconnaissance spacecraft—stressing that both would use the same booster rocket and similar onboard equipment. In April 1959 a revised proposal, approved by all relevant government agencies went further up to the Party authorities. The revised version proposed to build solely an automatic reconnaissance satellite and only mentioned briefly that the development of new technologies needed for the satellite would "make it possible in the future to start the development of an artificial reconnaissance satellite with a human on board." In May 1959 the Party and the government issued a secret joint resolution, authorizing the construction of an automatic reconnaissance satellite, code named *Vostok*, without mentioning the prospect of converting it into a piloted spacecraft. The appendix to the resolution included the development of several articles, smuggled in by Korolev's team, such as a pilot's ejection seat, a space suit, and life support systems.[21]

At this early stage, the competition between automatic satellites and piloted spaceships was resolved by making piloted ships also fully automatic so that they could be flown in both piloted and unpiloted modes. Because the first Soviet piloted spacecraft had to serve a dual purpose, both military and civilian, its controls also had to be dual, both automatic and manual.

With a fully automatic spacecraft at hand, spacecraft designers began carving out a role for the cosmonaut to play. By early 1960 the Special Design Bureau No. 1 completed the design of an automatic control system, and only after that did they began working on manual control. Unlike classical automation, which presumes a transfer of certain functions from a human to a machine, *Vostok* designers were concerned with a transfer of function from an existing automatic system to a human pilot. What needs an explanation here is not why the *Vostok* was automated but why it had a manual control system at all. Its purposes were to back up the automatic system in case of malfunction, to expand the window for controlled descent, and most importantly, to provide psychological comfort to the cosmonaut. As the designer of the manual control system Boris Raushenbakh put it, "the cosmonaut must be convinced that even if ground control equipment and the onboard automatic system fail, he would be able to ensure his own safety."[22]

While Gagarin had to limit his in-flight activity to monitoring and re-

porting, during subsequent *Vostok* flights the cosmonauts successfully tested the manual attitude-control system and performed other duties and experiments. In particular, they tested the possibility to carry out various military tasks in orbit. Korolev had previously suggested that the piloted version of *Vostok* could be used "to exterminate [enemy] satellites."[23] Kamanin noted with satisfaction that the tests performed by the cosmonauts Nikolaev and Popovich on *Vostok 3* and *Vostok 4* demonstrated that the human was "capable of performing in space all the military tasks analogous to aviation tasks (reconnaissance, intercept, strike). *Vostok* could be used for reconnaissance, but intercept and strike would require the construction of new, more advanced spacecraft."[24] For Kamanin, this justified a greater role for the cosmonauts to play on board and in the space program in general. Working with Nikolaev and Popovich on their official reports, he instructed them to promote the idea that "the 'central character' in space is a human, not an automaton."[25]

THE *VOSKHOD 2* MISSION: THE COSMONAUT TAKES CONTROL

The Soviet space triumphs were interpreted differently by different professional groups. The cosmonauts believed that the first spaceflights had demonstrated the human ability to perform in orbit, but the engineers viewed the same events as confirming the high reliability of automatic systems. Soviet engineers initially regarded the automatics and the cosmonaut not as a single integrated system but as two separate, alternative ways to control a spacecraft. They sought ways to make the automatic control system independently reliable rather than to optimize interaction between human and machine. The probability of a system malfunction that would require resorting to manual control seemed remote, and the manual control system did not seem to have primary importance for spacecraft designers. So when they redesigned *Vostok* for a three-man crew (the *Voskhod* mission) and later for a spacewalk (the *Voskhod 2* mission), it was the manual control system that got short shrift.

The *Voskhod 2* spacecraft featured an airlock and had to seat two cosmonauts in space suits, yet its cabin was the same size as Gagarin's *Vostok*. To fit in the new equipment, the designers turned the seats sideways. As a result, the main instrument panel and the optical sight used in manual orientation were no longer in front of the crew but on their left side. The crew could not see the Earth and perform attitude correction for retrofire from their seats. "In order to perform orientation, one had to lie across the seats. To tell the truth, this position is not quite natural, but we believed that in zero gravity this was not a big deal," recalled one of the designers. To make manual control in this awkward position possible, the engineers also moved the hand controller to the side. Upon seeing this, Korolev exploded and demanded to return the controller to its former place. Eventually the engineers managed to persuade

him that this was the only solution. "We quelled the storm. . . . Only during the postflight analysis did we realize the danger hidden in our solution."[26]

The engineers took additional measures to ensure the reliability of the automatic control system, yet when a life-threatening emergency occurred during the *Voskhod 2* flight, only the cosmonauts' ingenuity and skill saved their lives. On March 19, 1965 on the sixteenth orbit, the automatic attitude correction system started positioning the spacecraft for retrofire to slow it down for controlled descent. At that moment the solar attitude control sensor malfunctioned and retrofire was blocked. The ship remained in orbit. Mission Control had only two options—to try the automatics again or to resort to manual control.[27] Under the first option, if the automatics were to fail again, the ship would either have to remain in orbit for another day or to land outside the Soviet borders. The latter prospect horrified the decision makers so much that they chose the second option, never tried before: manual descent.[28]

Manual descent was considered a last resort option; it overruled the automatic blockage of retrofire.[29] The cosmonauts were on their own; they could not rely on automatics to check the proper orientation of the spaceship for retrofire. If they made a mistake, they could be stranded in orbit. Mission Control transmitted data for manual descent. The cosmonauts were to turn on the manual orientation system at 11:19 am, to issue the Descent-3 command at 11:24 am, and to ignite the retro-engine at 11:35:44.[30] The crew had to perform manual orientation in sixteen minutes, while this procedure nominally required twenty minutes.[31]

In order to execute manual orientation, the crew—the commander Pavel Beliaev and the second pilot Aleksei Leonov—had to perform true acrobatics. From their seats, the cosmonauts could not look through the optical sight or operate the hand controller, so they had to unbuckle their seatbelts and leave their seats. Beliaev also had to take off his space helmet because he could not bend his neck in it. He lay down across both seats, because only in this position could he use both hands to operate the manual controls. Yet in zero gravity, he tended to float up, and his space suit blocked the optical sight. Beliaev asked his crewmate to crawl under his seat and to hold him by the torso. After checking the pressure in the manual orientation system, Beliaev realized that he had enough for a single attempt. "Orientation had to be performed absolutely precisely and probably only once," he told the State Commission at a postflight briefing. "I did not hurry with pressing the retrofire button; I tried to orient the ship more precisely."[32] After pressing the retrofire button, Beliaev ordered a return to the seats. "We could not determine the time of firing," reported Leonov to the State Commission. "I had no watch. I could not see the onboard clock, and he [Beliaev] could not see it either. . . . We proceeded in the dark. I could not see the optical sight to check the orientation."[33]

Because the crew were out of their seats during the firing of the retro-engine, the ship's center of gravity shifted, and the ship began to rotate. Beliaev grabbed the hand controller and reestablished the proper orientation, while the retro-engine was working. As a result, the crew had no idea whether they were actually descending to the Earth surface or were being pushed up to a different orbit. Only the increasing g-loads indicated that they were indeed reentering the Earth atmosphere.[34]

Miraculously, *Voskhod 2* landed safely, though 368 kilometers (230 miles) from its planned landing site. The spaceship landed in the middle of a thick forest in deep snow, and before a rescue team was able to reach the crew they had to spend two nights hiding in their space capsule from hungry wolves.[35]

The *Voskhod 2* story also provided an interesting test case for determining responsibility for errors. Was the human crew or the automatics responsible for overshooting the landing site? The investigating commission noted that the flawed spacecraft design made it impossible for the crew to control the ship manually without leaving their seats, and at the same time, it criticized the crew for violating the rules. In the final report, the criticism of flaws in spacecraft design was dropped in exchange for removing the criticism of the crew.[36]

DESIGNING A COSMONAUT FOR *SOYUZ*

The second-generation Soviet spacecraft, *Soyuz*, was designed for a much wider range of missions than *Vostok*, including Earth-orbit rendezvous and docking. The problem of an efficient division of function between human and machine on *Soyuz* became the subject of a heated, if closely contained, debate within the Soviet space community. Two groups—the spacecraft designers and the cosmonauts—had very different perspectives on this issue.

The spacecraft designers, on the one side, argued that onboard automation had clear advantages. First, it allowed testing manned spacecraft in unmanned mode, thereby reducing time and expense on ground tests and increasing flight safety. Second, the high degree of automation made it possible to lower eligibility criteria and to reduce training time for cosmonauts. Finally, automation provided opportunities for correcting errors in flight.[37] The engineers were willing to assign the cosmonauts a backup function but preferred keeping the automatic mode as nominal.

The cosmonauts, on the other side, believed the automation of control functions was excessive, and it hampered the progress of human spaceflight. They argued that a human operator would increase the reliability and effectiveness of a space mission. They especially stressed the human ability to act in unexpected situations, to cope with equipment failures, and to perform in-flight repairs. They argued that full automation alienated the pilot from

his craft. They insisted that instead of fitting the human into an existing technological system, one must design human activity first and then determine specifications for the technological components of the system.[38]

The Soviet space program's organizational structure (or lack thereof) gave the spacecraft designers a decided advantage over the cosmonauts in such internal disputes. The Soviet space program was not supervised by a central government agency like NASA but was scattered over a large number of defense industry, military, and academic institutions. The chief contractor for *Soyuz*—Korolev's Special Design Bureau No. 1—exercised unprecedented control over the course of the space program. Korolev himself, in particular, played a central role in decision making on a whole range of issues going far beyond engineering, such as spacecraft procurement, cosmonaut training, crew selection, programming of missions, and ground flight control. It was the engineers' vision of the proper division of function between human and machine that was largely implemented in the Soviet space program.

Soyuz designers recognized that manual control would "make it possible to get rid of a number of complex pieces of equipment and to simplify automatic control systems."[39] Compared to *Vostok*, they significantly broadened the range of manual control functions, but these new functions involved not so much piloting as monitoring numerous onboard systems and dealing with equipment malfunctions. A *Soyuz* cosmonaut was a different type of cosmonaut, an engineer more than a pilot.

On the Soyuz program, requirements for the skills of the crew, selection criteria for the cosmonaut corps, and the very professional identity of cosmonauts began to change. The first group of Soviet cosmonauts that flew on *Vostoks* were selected from among young fighter pilots, who had little engineering background and modest flight experience compared to the more educated and experienced test pilots selected for the Mercury astronaut group.[40] Korolev chose fighter pilots based on their universal skills as pilots, navigators, radio operators, and gunners.[41] Operating a technologically sophisticated *Soyuz* spacecraft required serious engineering skills. Two solutions to this problem emerged, advanced by two rival professional groups, each pursuing their own interests.

Air Force officials, who managed the selection and training of cosmonauts, feared that engineers of the space industry might lay a claim to cosmonaut seats on *Soyuz*. To counter such claims, the Air Force decided to raise the level of engineering expertise among cosmonaut pilots. In December 1963 the Air Force requested that five flown cosmonauts be sent to study engineering at the Zhukovskii Air Force Engineering Academy. Despite the cosmonauts' reluctance (they preferred serving as instructors to new cosmonauts or training for new flights), they were sent to the Academy and acquired engineering

diplomas.[42] Soon the rest of the cosmonaut corps were similarly requested to study at the Academy, and a college degree was made a requirement for cosmonaut selection.

The space engineers, working under the Ministry of General Machine-Building and under other defense industry agencies, had a different solution. They insisted that on a two- or three-seat *Soyuz*, control functions could now be divided among the crew members, and narrow specialists, more skilled in one task than another, could be brought on board. This would open the door for the engineers to enter the cosmonaut corps and even become members of lunar mission crews. With the cosmonaut professional identity at stake, the Air Force vehemently opposed such plans. Kamanin wrote in his diary, "There will be a huge and prolonged fight."[43]

Both sides skillfully used the deficiencies in the organizational structure of the Soviet space program to encroach on each other's territory. Spacecraft design and cosmonaut training were institutionally separated: the design and production of spacecraft was conducted under the Ministry of General Machine-Building, and cosmonaut training was the responsibility of the Air Force. Air Force officials complained that the cosmonauts had very little input in spacecraft design. They pointed out that in the aviation industry experienced pilots were regularly consulted during the design phase, while the cosmonaut pilots were entirely left out of spacecraft design.[44] Acquiring engineering degrees, with diploma topics in spacecraft design, gave cosmonaut pilots the right to claim expertise in both piloting and design, thus getting advantage over the rival group.

The engineers, for their part, insisted that spaceflights were in effect in-flight tests of space equipment, which had to be conducted by experienced engineers. Vasilii Mishin, who succeeded Korolev as chief designer after his death, argued that "design solutions can only be checked [in flight] by highly qualified specialists directly involved in designing and ground testing of the spacecraft."[45] Thus, instead of involving cosmonaut pilots in spacecraft design, he proposed to train space engineers as cosmonauts, and to let them test new systems in flight.

Soon Mishin took practical steps toward changing the composition of the cosmonaut corps. In May 1966 the Special Design Bureau No. 1 set up a flight-methods department for training a civilian group of "cosmonaut testers."[46] This rapidly led to an open confrontation with Air Force officials, who defended their monopoly on cosmonaut selection and training. Wielding his influence with the Soviet leadership, Mishin threatened that only engineers and scientists would fly and that training at the Air Force Cosmonaut Training Center would be simplified or dispensed with altogether.[47] Eventually, a compromise was worked out by which a typical *Soyuz* crew would include one

military pilot as mission commander, one civilian engineer, and one flight researcher, in whose seat military and civilians would alternate.[48]

As spacecraft designers began to enter the cosmonaut corps, they introduced elements of engineering design into the planning of cosmonaut activity. The control system engineer and cosmonaut Aleksei Eliseev designed a step-by-step procedure (a *cyclogram*) for a transfer from one spacecraft to another by spacewalk, which he himself carried out during the *Soyuz 4*/*Soyuz 5* mission. Eliseev specified all the actions and code words for every crew member. The procedure was recorded on a four-meter-long (thirteen-feet-long) scroll of paper.[49] The engineers set up a special department, which designed cosmonaut activity so that it conformed to the logic of onboard automatics. Control system designers worked in close contact with human engineering specialists, who viewed the spacecraft control system as a "cybernetic 'human-machine' system."[50] Subtly redefining the cosmonaut identity, spacecraft designers avoided using the word "pilot" and preferred the term "spacecraft guidance operator."[51] The cosmonaut had to fit into an existing technological system, and human performance was effectively evaluated in machine terms.

The cosmonauts began to resent what they perceived as "excessive algorithmization" of their work. They argued that the strict regulation of cosmonauts' activity on board forced them "to work like an automaton" and stripped them of the possibility to plan their actions in their own way.[52]

SOYUZ FLIGHTS: DIVIDING GLORY AND RESPONSIBILITY BETWEEN HUMAN AND MACHINE

Several emergency situations that occurred during *Soyuz* missions underscored the crucial importance of human-machine issues for spacecraft control. As the boundary between human and machine functions was often blurred, so was the responsibility for error. While accident investigators tended to assign the responsibility for error to either human or machine, failures were often systemic. In an emergency, rigid control schemes often had to be reconsidered and human and machine functions had to be redefined. Ground controllers frequently stepped in, further complicating the division of responsibilities. Ultimately, what often decided the success of the mission was not how much or how little the cosmonauts did but how well they were integrated into the control system, which included both the onboard automatics and mission control.

In April 1967 *Soyuz 1*, piloted by Vladimir Komarov, was launched for a planned manual docking with another spacecraft. The assignment of responsibility for docking to the human pilot did not cause a controversy. The engineers had full trust in the operation of the automatic rendezvous system that was to set the two spacecraft in a perfect position for manual docking. "They did not appreciate the dynamics and complexity of manual docking after or-

bital insertion, and they also counted on the perfect operation of automatics," recalled the cosmonaut Vladimir Shatalov.[53] Even before the second spacecraft was launched, *Soyuz 1* experienced multiple equipment failures, and the mission had to be aborted. Komarov successfully performed manual attitude correction with a new method invented during the flight, for which he had no prior training. Gagarin, who served as a capcom on that mission, told the leading control system designer, "What would we have done without a man on board? Your ionic system proved unreliable, the 45K sensor failed, and you still don't trust cosmonauts."[54] In the end, yet another automatic system—the parachute release—failed, and this time, the cosmonaut had no manual means to override it. The spacecraft hit the ground at full speed, killing Komarov.

In October 1968, a similar mission was launched, with a planned automatic rendezvous and manual docking. This time the automatics worked well, yet the cosmonaut Georgii Beregovoi on *Soyuz 3* failed to perform manual docking. He misread the target vehicle indicators and attempted to approach the target upside down. Engineers regarded this as a clear human error, but Kamanin—responsible for cosmonaut training—pointed out that the actual manual control system on board in certain respects differed from the version installed on the ground simulator and that the cosmonaut did not have adequate time to adjust to zero gravity. "I did not find my place within a human-machine structure," admitted Beregovoi. He complained that the hand controllers were too sensitive, sending the spacecraft into motion at the slightest touch: "This is good for an automatic system, but it generates unnecessary nervousness in a human being."[55] Kamanin interpreted this incident as a systemic failure, rather than simply a human operator error: "If even such an experienced test pilot [as Beregovoi] could not manually perform the docking of two spaceships, this means that the [manual] docking system is too complex to work with in zero gravity."[56]

The leaders of the Soviet space program began lobbying for the use of automatic docking. Two successful automatic docking missions of unmanned spacecraft in October 1967 and in April 1968 strengthened the belief that human participation in docking was unnecessary. Yet spacecraft designers were eager to prove that their manual control system was actually operable. Mishin insisted on trying manual docking on the *Soyuz 4/Soyuz 5* mission in January 1969, even though his boss, the Minister of General Machine-Building Sergei Afanas'ev, pressured him to resort to the proven automatic docking system.[57]

This time the engineers made sure that the cosmonauts received more than sufficient training on the ground. Shatalov, the commander of *Soyuz 4*, performed at least 800 simulated dockings in various regimes on a ground simulator.[58] Later on, the requirement for crews training for rendezvous missions was reduced to 150 simulated dockings.[59]

Despite all the training, superiors pressured Shatalov to agree to automatic docking, with the manual option as an emergency backup. Kamanin reportedly told him, "Why do you insist on manual docking? If the automatics fail, it is not your fault, you are ok, and you've had your flight. And if you persist, the question will arise whether to send you or another crew." Shatalov bluntly refused:

> I was a firm proponent of manual docking. I had to fight for it to the last day. Even my crewmates told me, "Why do you insist on piloting? Why only by hand? Let it go, or they would not let us fly at all. They would send the backup crew, who agree to automatic docking." But I believed that my position was more logical. They told me that if the automatics failed, then I would take over and correct things. But how could I do that without first trying out spacecraft controls, without making sure that the spacecraft followed my commands, without making sure that I could do with it whatever I wanted? How could I grab the controls at the last moment, when the craft was drifting in the wrong direction, and direct it without knowing how it would react? So I told them that I needed to try out manual control in advance to get a feel for it, to get the assurance that the craft followed my commands and performed maneuvers like on the simulator. This dispute lasted until the launch.[60]

In the end, Mishin threatened the opponents that if they kept insisting on automatic docking, he would scrub the launch and order a formal review of the entire cosmonaut training program. Only then was Shatalov allowed to do manual docking, which he performed flawlessly. The training on ground simulators paid off. "Surprisingly, the simulator imitated the real docking very well," recalled Shatalov. "I did not perceive any difference in the skills acquired on the simulator and the skills I gained in the actual piloting of the spacecraft. After our crew performed 1,200–1,300 training sessions on a simulator at the center, we got used to each other so much that during the flight, in the heat of the moment, I had a feeling that I was back on Earth on a simulator."[61]

The next mission, in October 1969, was to rely even more heavily on cosmonauts' piloting skills. It was a complicated orbital maneuver with three spacecraft: *Soyuz 7* and *Soyuz 8* would attempt an automatic rendezvous with manual docking, while *Soyuz 6* would manually maneuver to capture the docking on camera. Shatalov was chosen to pilot the active ship, *Soyuz 8*, precisely because of his demonstrated manual docking skills. Unfortunately, the automatic approach system on *Soyuz 8* failed, when it was about 1,000 meters (3,280 feet) from *Soyuz 7*. Even though the distance was too large for manual approach, Shatalov decided to take a risk and asked permission to attempt it. "After a while, Mission Control figured out that it was a hardware failure, and

they gave both ships the parameters for manual maneuvers to bring us together again. The calculations were done in a hurry and were not very reliable. While we were performing these maneuvers, the other ship flew by, and we did not see each other," recalled Shatalov, the commander of the active ship *Soyuz 7*.[62] Manual approach was no longer an option. The next day, through orbital maneuvers, the ships were brought within seventeen meters (fifty-five feet) from each other, but without any means for the crews to determine their relative velocities, all attempts at manual approach also failed.[63] The crews had to return to Earth without completing their mission.[64]

The *Soyuz* design prioritized onboard automation and ground control over crew's autonomy and thus limited manual control options for the cosmonauts. The crews lacked technical means to obtain crucial information needed for speedy decision making and for effective manual control, if the automatic approach system failed. According to Shatalov, spacecraft design severely constrained his ability to maneuver his spaceship for approach and docking:

> I could only look through the periscope, plus or minus 7 degrees, so I had to "lose" the other ship, turn to face it with a side window, find it again, slow down, and then turn toward it again. . . . The situation was very complex, with such a large relative velocity and very primitive means for mutual orientation. We tore off a thread that attached a pencil to the log journal, and, using band-aids, affixed that thread to a large window to mark a line, and I tried to maneuver our ship so that the target point moved along that line, and then to turn on the engine and slow down. . . . We never trained for such a procedure. I had to . . . send the flight engineer [Aleksei Eliseev] into the orbital module, where he could see everything, while I stayed at the controls in the main cabin. He gave me directions for maneuvers, and I piloted without seeing anything. This was tough. . . . it was a technically impossible task at that time.[65]

Kamanin later bitterly remarked in his diary: "Everything [on *Soyuz*] is based on the assumption of flawless operation of automatics, and when it fails, cosmonauts are left without reliable means of control."[66] Yet the responsibility for the failed mission was placed on the cosmonauts.[67] Chertok later admitted that the designers were to blame for overestimating human capabilities and for not providing adequate training on simulators for the situation of failure of the automatic approach system.[68]

THE ROLE OF GROUND CONTROL

The norms of cosmonaut activity included not only following the technical protocol of interaction with onboard equipment but also following the social protocol of subordination to their superiors on the ground. Framing the

whole issue as human versus machine is somewhat misleading. The real issue here was not so much the division of function between human and machine but the division of power between the human on board and the human on the ground.

Chertok acknowledged that the growing complexity of space technology warranted a greater role for the human operator, but his idea of human participation was to involve "not just an individual, but an entire collective,"[69] meaning the flight controllers and specialists on the ground. The real control of the mission remained in the hands of engineers: either through the automatic systems they designed or through their design and management of cosmonaut activity.

The organization of Mission Control was quite complicated. The early piloted flights were controlled by members of an ad hoc State Commission, located at Baikonur, who received information from military control centers in Moscow, which, in turn, collected it via a network of military tracking stations. In 1966 one such station, located in Yevpatoria in Crimea, became a dedicated flight control center and served in this capacity until 1975. The control of flight operations was entrusted to Yevpatoria-based chief operations and control group, which included representatives from the military, design bureaus, production plants, and the Soviet Academy of Sciences. The group oversaw three shifts of flight controllers and several teams of technical experts. The State Commission, appointed by the Soviet government for each flight, retained overall authority, but it now based its decisions on recommendations from the control group.[70]

The Yevpatoria center had powerful antennas but only primitive ground communication equipment. "We controlled spaceflight while sitting on creaky chairs in front of a wall with hanging posters, holding a bunch of telephone receivers," recalled Chertok. In April 1968, when descriptions and photographs of the American Mission Control Center in Houston reached his colleagues, they were shocked: "Judging by the enormous presence of electronic computer technology and automatic data-processing and display facilities, they had gotten so far ahead of us that our comment about our own Center for Deep Space Communications in Yevpatoriya was: 'It's the Stone Age, and we are cavemen admiring our cave drawings." "We still made correct decisions," asserted Chertok.[71] What looked right from the ground, however, did not necessarily seem so from the orbit.

In January 1969, during his *Soyuz 4* flight, Shatalov missed an excellent opportunity to dock early with *Soyuz 5*, because he lacked authority to make autonomous decisions. He had to follow the strict sequence of planned actions or wait for commands from the ground, even if the situation presented favorable opportunities. He recalled:

> As a result of ideal orbital insertion and my maneuvering, our ships approached even before the moment when I was supposed to turn on the automatic rendezvous system. I saw the other ship as a little star and was surprised how big it was. I saw that star and noticed that everything was still but that star was moving, so I figured it was the other ship. Yet I had to sit and wait for the moment to turn on the automatic rendezvous system. Then we came very close, but it was forbidden to turn anything on until the planned time. I saw through a window that the other ship was approaching, and we nearly bumped into each other, so ideal was the approach. Then through another window I saw the ship passing by, within 70 m or so, and could see many details of the ship. Yet since this all happened on the opposite side of the Earth, not where it was planned, we had to come apart, and the other ship drifted about 3 km away. Only after that, at the designated moment, I turned on the automatic rendezvous system. It began to search for the other ship, found it, started the rendezvous process, and then I performed manual docking.[72]

The *Soyuz 4*/*Soyuz 5* mission was ultimately a success; however, on another occasion the lack of decision-making authority for the crew led to a mission failure. On August 26, 1974 the Soviet spacecraft *Soyuz 15* was approaching the military orbital station Almaz, publicly disguised as a civilian station Salyut 3. The approach and docking were to be performed in the automatic mode, and the two-man crew—commander Gennadii Sarafanov and flight engineer Lev Demin—were routinely monitoring the work of onboard systems. Suddenly, at the distance of 350 meters (1,150 feet) from the station, the Igla automatic rendezvous system on *Soyuz* malfunctioned. It misjudged the distance, and instead of slowing the spacecraft down, it issued a command to start acceleration. *Soyuz* charged toward the station at high speed and barely avoided deadly collision. Shatalov, who by that time had replaced Kamanin as the Air Force supervisor of the cosmonaut corps, with great effort managed to convince the State Commission to agree to manual docking. Yet the engineers controlling the flight still refused to hand over control to the crew:

> I entered the office of the flight control group. Boris Chertok was there, Armen Mnatsakanyan (the head of the firm that built the automatic rendezvous system), and Aleksey Yeliseyev (the head of flight control). I told them, "By the order of the State Commission, switch to manual control!" They told me to wait. Mnatsakanyan said, "We need to see what exactly is going on." I told them, "Switch right away!" The distance was 800, 700, 600 m . . . They said, "You are always for manual control. You are a fanatic of manual control!" I said, "Switch now! Everything will be all

> right, the crew will manage." They said, "Wait, everything will work ok." The spacecraft again reached the distance of about 400 m, and again the powerful engine gave a big thrust and pushed the ship past the station. We were lucky there was no collision, or there would have been such sparks . . . Then they realized I was right.[73]

The cosmonauts, caught between malfunctioning technology and risk-averse ground control, believed that "they evaluated the situation far more accurately than those on the ground" but did not receive the permission to switch to manual control. In their view, "the crew had nothing to reproach itself for." "A risk could be taken and they were ready to take the risk," they argued. "But the ground decided otherwise."[74] Out of communication range, the cosmonauts made a third attempt at approach, which also failed. Due to the low level of remaining propellant, the crew was ordered to return to Earth without completing their mission. Two of the three planned expeditions to Salyut 3 had to be canceled, the station's orbit decayed, and soon it was lost.[75]

After the flight, heated debates erupted over the question whether the main responsibility for the failed mission should be assigned to human or machine. Engineers argued that the cosmonauts should have recognized the malfunction immediately and should have resorted to manual control. Officials responsible for cosmonaut training replied that this particular type of emergency had not been included on the list, and that the cosmonauts had not been trained for it. The investigation was further complicated by the fact that this failure occurred just a year before the scheduled docking of *Soyuz* with *Apollo*. The American side, worried about the reliability of the Soviet rendezvous system, requested an explanation of the *Soyuz 15* incident. To downplay the failure of the automatic docking system, the Soviets preferred to put the blame on the cosmonauts—for not shutting down the malfunctioning system after the first failure.[76] Chertok alleged that the crew did not understand what was happening and in the postflight report proposed "increasing the reliability of the human factor."[77] A draft of the final report also blamed the crew for not carrying out the instructions of Mission Control on the third docking attempt. Then Shatalov threatened to submit a dissenting opinion to the Party Central Committee, revealing to the Party authorities that the flight control group disobeyed the decision of the State Commission that allowed manual docking. Chertok ultimately supported him. The commission chairman said, "Okay, we won't mention either thing. Let's write, 'Because of a malfunction, docking did not take place.'"[78] Yet neither cosmonaut ever flew in space again.

Rather than being an exclusively human or machine error, the *Soyuz 15* mission illustrates another systemic fault: a failure to integrate the crew in the control loop in a human-machine system. The crew was kept in "cold re-

serve," passively monitoring the operations of the automatic docking system. When this system failed, the crew was not ready to take over control operations quickly. Although the engineers switched the blame to the crew, it was the engineers' design of the control system that placed the crew in the role of passive observers. Engineers tacitly admitted that the failure of the *Soyuz 15* mission had roots in the overall organization of rendezvous control, including the role of ground control. A special operational group was created as part of Mission Control to develop procedures for automatic and manual rendezvous in various emergency situations and to provide real-time recommendations for the flight director.[79]

After that incident, cosmonaut pilots were assigned responsibility for manual approach from the distance of 200 to 300 meters (650 to 980 feet). In just three years, however, this rule was subjected to a severe test. In October 1977 the *Soyuz 25* crew made an attempt at manual docking with the Salyut 6 station, and when the spacecraft almost touched the station, they suddenly realized that they were facing the "bottom" of the station, instead of the docking port. They quickly turned away from Salyut 6 and made several more docking attempts, all of which failed. Having spent much propellant, *Soyuz 25* did not have enough fuel even to back up from the station and remained in close proximity to it for several orbits.[80] What the cosmonauts perceived as the "bottom" of the station was in fact the docking port. *Soyuz 25* approached the station from a slightly different angle than was expected, but the cosmonauts were not trained on a ground simulator to recognize the station from that angle. The "conditioned reflexes" they acquired during incessant training on the simulator prevented them from recognizing the correct position of the station.[81] Although the error was rooted in the inadequate simulator design, the cosmonauts bore their part of the blame. For the first time, the cosmonauts were not awarded the title of the Hero of the Soviet Union.[82] Mission planners decided not to send all-rookie crews into space ever again. Most important, it was decided to make the automatic docking regime nominal, and the cosmonauts were allowed to take over manual control only in case of failure of the automatic system.[83] The prolonged struggle for the right to control docking between human and machine began to shift in favor of the latter.

THE LUNAR PROGRAM: A FORCED TURN TOWARD MANUAL CONTROL

The lunar race further complicated the debates over the human role on board. Lunar missions were to be conducted in large part out of communication range with the Earth, and ground stations could not effectively control the entire flight. The division of control functions between human, onboard automation, and ground control had to be reevaluated. Initially it was decided to give the cosmonauts an unusually high degree of control over their

spacecraft. Aleksei Leonov, who initially trained for a circumlunar mission, recalled that "we had to be able to perform every aspect of the flight manually in case the automatic system failed."[84] Later on, the internal politics of the Soviet lunar program began to erode this principle.

From the very beginning, the Soviet lunar program suffered from lack of coordination, internal rivalries, duplication of effort, and fracturing of resources. At first, the heads of two rival design bureaus—Sergei Korolev and Vladimir Chelomei—divided the lunar pie more or less equally: Korolev worked on a lunar landing project, while Chelomei developed a rocket and a spacecraft for a circumlunar flight. After Khrushchev's ouster in October 1964 and the subsequent shakeup in the upper echelons of Soviet power, Chelomei lost some of his political support, and Korolev eventually wrestled the circumlunar flight project away from him. In October 1965 a government decree assigned Korolev the responsibility for the development of the 7K-L1, a new spacecraft designed specifically for a circumlunar flight, later publicly named *Zond*.

One major hurdle in the Soviet lunar program was eliminated: all work on lunar spacecraft was now concentrated in one organization, Korolev's design bureau. Yet the circumlunar flight and the lunar landing remained two separate projects with different goals, independent work schedules, different booster rockets, separate ground infrastructures, and two different types of spacecraft—the L1 and the L3. The addition of the circumlunar project to Korolev's tasks stretched the resources of his design bureau and messed up the lunar landing project schedule. The circumlunar project was given immediate priority in order to complete it by the celebration of the fiftieth anniversary of the Great October Revolution in November 1967.

Social and political factors influenced the lunar program down to the very technical level. Korolev had to split the responsibility for the development of the control system for the L1 spacecraft with the organization led by his old friend Nikolai Piliugin. As a result, Piliugin developed the automatic control system for course corrections and reentry, while Korolev assumed responsibility for manual rendezvous.[85] The cosmonaut functions on board were thus constrained by the division of responsibilities between different design organizations.

The L1 spacecraft was fully automated and could perform its circumlunar mission in the unpiloted mode. As a backup, the designers installed a manual system for all four critical corrective burns.[86] For the first time in the Soviet piloted space program, the L1 control system included a digital computer, *Argon-11*. This computer was part of the automatic control system designed by Piliugin, and cosmonauts had no access to it.[87] The manual control system included a digital computing device called Salyut 3, which was not reprogrammable; it gave the cosmonauts fixed options for selecting one of the

preset programs. According to the control panel designer Iurii Tiapchenko, the L1 panel was a step backward in comparison with *Soyuz*: "The functions of cosmonauts were reduced to the simplest operations of entering commands and controlling their execution in accordance with flight instructions and the orders issued by ground control."[88]

In 1967–68, the Soviets made eight attempts to launch the L1 on a circumlunar mission in the unpiloted mode. Only one mission completed a circumlunar flight; all missions were fraught with numerous failures that might have been fatal to a human crew. The cosmonauts Leonov and Popovich, who were training for the circumlunar flight, claimed that they would have been able to pull off the mission, if only allowed to overrule the automatics.[89]

After the successful orbiting of the Moon by *Apollo 8* in December 1968, the L1 program lost its political rationale. After another failed L1 mission in January 1969, the plans for a piloted flight were suspended. Eventually the program was canceled without a single attempt for a piloted flight. The cosmonauts unsuccessfully petitioned the Soviet political leadership for continuation of the piloted circumlunar program.[90] The only completely successful L1 test mission took place on August 8, 1969. The passengers on the spacecraft were four male tortoises. Two cosmonauts, Aleksei Leonov and Oleg Makarov, participated in the mission as ground operators.[91]

Although the circumlunar flight could in principle be performed automatically, the more complicated lunar landing mission required a substantial human role. The Soviet lunar landing profile was based on a lunar orbit rendezvous scheme similar to *Apollo*. Because of the limited thrust of the Soviet lunar rocket, however, the weight of the Soviet lunar lander had to be roughly one-third of the weight of the *Apollo* lander. For this reason, the Soviets planned to send only two cosmonauts on the lunar mission: one cosmonaut landing on the Moon, and the other staying on the lunar orbital ship.

Severe weight limitations forced Soviet designers to give the cosmonauts a much wider range of functions. In particular, to reduce the bulk of docking equipment and to eliminate extra dockings, the engineers proposed to transfer the cosmonaut from the orbital ship to the lander and back via spacewalk.[92] Lunar landing was planned to be automatic with partial manual backup.[93] Using an onboard computer, a cosmonaut would receive information from various sensors, evaluate the condition of the lander according to preprogrammed algorithms, and choose specific actions. At a crucial moment, the cosmonaut would manually select a landing site on the lunar surface and give instructions to the computer to execute required landing maneuvers.[94]

Weight limitations imposed drastic restrictions on the amount of fuel for landing maneuvers, thus requiring extraordinary performance from the cosmonaut. On the *Apollo* lunar landing module, two astronauts had three min-

utes to evaluate the situation and choose a landing site or make a decision to abort landing.[95] According to the initial design of the Soviet lander, a single cosmonaut, with a much narrower observation angle, would have to make this vital decision within only fifteen to twenty seconds. Minister Afanas'ev remarked that, under such severe weight limitations, "we would be able to land only a half-man on the Moon." President of the Soviet Academy of Sciences Mstislav Keldysh declared that he would veto a design that gives a cosmonaut only twenty seconds for decision making.[96] In the end, the decision time was increased to between thirty and forty seconds.[97]

Gradually, Chief Designer Mishin began to limit the responsibilities of the pilot, placing greater emphasis on automatic systems. This happened at the same time as he attempted to increase the role of civilian cosmonauts, engineers from his own design bureau. Cutting on manual control functions made it possible to reduce cosmonaut training time, and civilian cosmonauts, who generally had less training than military pilots, could now compete with the pilots for seats on the lunar landing mission. In late 1967 Mishin cancelled contracts for lunar landing training vehicles and ordered to simplify the specifications for an L3 ground simulator.[98]

In his diary Kamanin railed against Mishin's reliance on automatic controls: "Our view is that the crew must guide the spacecraft and control the operation of onboard automatic systems, while Mishin reduces the role of the cosmonauts to guinea pigs." According to Kamanin, Mishin intended to limit cosmonauts' activity to "observations and psychophysiological feelings." "He believes that the decisive role in controlling spaceflight belongs to automata, not to the human. 'Automata in space are everything; the human is only an appendix to the automatic systems of the ship'—this is Mishin's deliberate stance," fumed Kamanin.[99] Mishin insisted on combining the commander's handbook with the log journal in a single document. Kamanin immediately detected here an attempt to "exclude from onboard documentation everything that helps the crew understand the functioning of automatics and to control the operation of automata—the same old attempts to turn the cosmonauts into guinea pigs."[100] Kamanin ordered the cosmonauts to resist Mishin's encroachment.

The growing degree of onboard automation in the lunar program alarmed the cosmonaut pilots. Leonov commented that "according to the flight plan the automatic system took precedence": the cosmonauts were allowed to resort to manual control only in case of failure of the automatic system. "I had argued," continued Leonov, "that, as commander of a spacecraft, what I needed once a flight was in progress was as little communication as possible from the ground—since it served mainly to distract me from what I already knew was necessary—and only manual, not automatic, control."[101]

A reentry of the lunar spacecraft into the Earth atmosphere posed a series of challenges. Specialists in ballistics recommended a "double skip" trajectory: the spacecraft would first dip into the Earth atmosphere over Antarctica, slow down, skip back into space, and then make the final reentry. The first "dipping" placed particularly high demands on the precision of spacecraft trajectory. The designers initially favored an automatic option. An automatic system, they argued, was "in principle better than a manual one, because the former does not depend on the condition of the human, his mood, health, and skills." Yet they preferred to add a manual system as a backup, to simplify the automatic system and to "insure against possible oversight." The problem was that a cosmonaut would have to control the spacecraft while experiencing the g-force of five to six g. The designers conducted thousands of tests, trying various controllers and display devices that might be used under such conditions but still could not figure out an optimal division of function between human and machine. "When we assigned complex control functions to the human, he did not achieve the required precision of reentry. His errors could lead to huge overshoot or undershoot, up to 1,000 kilometers [620 miles], which was clearly unacceptable. If we assigned only simple functions to the human, however, his participation did not simplify the automatic system and thus defied its purpose."[102] The designers failed to find a reasonable balance of functions. By the time the lunar program was terminated, this problem remained unresolved.

Only after the successful landing of *Apollo 11* the Soviet government finally issued an order to build a lunar landing simulator for the L3 mission. The simulator was to be ready by May 1970.[103] In the meantime, lunar crews were training to obtain test pilot licenses. Their training included a helicopter landing with the engine cut off, a very difficult and dangerous operation, which had nothing to do, however, with an actual lunar landing. An experienced flying instructor, cosmonaut Shatalov developed a training technique for Soviet lunar crews to simulate lunar landing, but the training program never started. By the time a flying simulator was built, the lunar program ground to a halt.[104]

The lunar landing program suffered from a series of setbacks during the failed launches of the giant N1 lunar booster rocket. The last attempt was made in 1972, and soon the program was terminated. The cosmonauts had hoped that they might have a chance to fly the lunar spacecraft during a series of Earth-orbit test flights in 1970–71. The financial difficulties that besieged the Soviet lunar program, however, forced Mishin to cancel lunar orbiter test flights and to test only the lunar lander and only in the unpiloted mode. During three tests in Earth orbit, the lunar lander successfully simulated a lunar landing, two liftoff operations with the primary and backup engines, and an entry into lunar orbit. The automatic control system worked perfectly.[105]

Whether the manual system for lunar landing would have worked remains unknown. Even if the other components of the lunar program came together, the lack of a manual system for reentry still would have held the program back.

The Soviets initially had great difficulty dividing the responsibility for the lunar program between different design bureaus. Dividing the functions between human and machine proved even more difficult; they did not find a solution. The Soviets kept the existence of their piloted lunar program secret for twenty-five years. Instead, they cultivated the myth that exploring the Moon with automatic probes was their one and only goal.

DEFINING THE COSMONAUT PROFESSION

The seemingly technical issue of onboard automation raised a larger question of the nature and purpose of human spaceflight. The debates over automation reflected three competing visions of spaceflight: a piloting mission, an engineering task, and a research enterprise.

The first cosmonaut group was composed of military pilots, and they used their growing prestige and political influence to maintain their monopoly on spaceflight. In May 1961, shortly after his historical first flight, Yuri Gagarin sent a letter to the Chief Marshal of Aviation Aleksandr Novikov, arguing that "only pilots are capable of carrying out spaceflights. If others want to fly into space, they must learn to fly aircraft first. Aviation is the first step to spaceflight."[106] In 1962 Korolev for the first time raised the question of including engineers in space crews, and Kamanin called this "a wild idea."[107] The military pilots strongly objected to the waiver of "harsh physical tests" for engineers, insisting that the pilots were "the real veterans in the [cosmonaut] corps."[108] Marshal Andrei Grechko, then the first deputy minister of defense, said bluntly that "we will select cosmonauts only from among robust young fellows from the military. We don't need those ninnies from civilian science."[109]

Space engineers, for their part, insisted that they had a legitimate claim for a spacecraft seat. Chertok argued that "a good engineer could control a spacecraft as well as a pilot if there were no obvious medical contraindications."[110] Spacecraft designer Feoktistov compiled a chart comparing the professions of the cosmonaut and the pilot and tried to show that piloting skills were unnecessary aboard a spacecraft, but Kamanin interpreted the same chart in the opposite way.[111] Powerful lobbying by the chief designers, who enjoyed direct access to the Soviet leadership, however, forced the military top brass to compromise. Kamanin eventually agreed to include civilian specialists in the cosmonaut corps.

The debate over the necessity of piloting skills for the cosmonaut profession may have played a role in the selection of the first woman cosmonaut.

After training, medical tests, and theoretical exams, Kamanin ranked the five members of the first women's group of cosmonauts in order of flight readiness. Ponomareva, an engineer and a pilot with excellent test marks, was ranked first, and textile worker Tereshkova, with no engineering or piloting experience, was ranked fifth.[112] Despite the ranking, Tereshkova was chosen for the first woman's mission in June 1963.[113] Choosing a nonpilot for the first woman cosmonaut played well into the hands of the space engineers in their debate over the necessity of piloting skills in orbit. Launching Tereshkova was to prove that one did not have to be a pilot in order to perform manual control of a spacecraft. Chertok put this bluntly: "any physically and mentally normal individual who has been trained for two to three months can control [a spacecraft]—even a woman!"[114] Evoking a woman as a paradigmatic example of an unprepared novice is quite suggestive about the gender bias in the masculine culture of Soviet space engineering.

When Tereshkova, struggling with debilitating nausea in orbit, failed to perform a spacecraft orientation exercise on her first attempt, the engineers faced a serious dilemma. They did not want to blame it on equipment failure, yet they did not want it to appear as her fault either, because they feared it could be used as an argument against sending nonpilots into space. As neither alternative suited the engineers, the matter was laid to rest.[115] Feoktistov flew the *Voskhod* mission the following year, bringing both prestige and influence to the space engineering corps. Soviet women were not sent into space for the next nineteen years.

Engineers argued that their presence on board had dual benefit: a better handling of emergency situations during the flight and a better design of spacecraft resulting from their flight experience. The engineer-cosmonaut Eliseev reasoned that, as space technology was becoming more and more complex, it would be impossible to write down instructions for all conceivable emergencies. A situation may arise in which only spacecraft designers on board would be able to find the right solution. He also suggested that "one could design onboard equipment for the cosmonauts only with their own participation. Only people who carry out spaceflights can give competent assessments and recommendations about the convenience of using various types of onboard equipment."[116] Instead of involving cosmonaut pilots in the design process, this argument was used to include engineers in space crews. In April 1967 the engineer-cosmonaut Oleg Makarov met with Mishin and proposed a list of measures aimed at changing the role of humans on board. Makarov argued that an engineer must be included in every space crew, that crews must study onboard equipment at the design and production sites, not just on simulators, and that cosmonauts must be given the right to take over control in case of malfunction of automatic systems.[117]

Kamanin realized that engineers-turned-cosmonauts might soon replace the cosmonaut pilots whose training he oversaw. He quickly reorganized the training of the cosmonaut pilots, hoping to turn them into engineers. In February 1965 the Cosmonaut Training Center set up eight research groups focused on the following problems: military use of spacecraft; space navigation, life-support and rescue systems; telemetry equipment; scientific orbital stations; circumlunar flight; lunar landing; and weightlessness. Each group would study the assigned problem, formulate the center's positions on specific issues, and defend those positions before scientists and designers.[118] While spacecraft designers were claiming a seat on board, the cosmonauts began to claim a seat at the designers' workstation.

In the 1970s, with the introduction of orbital stations, mission engineers began playing an ever-growing role in spaceflight. Long-duration missions required such skills as equipment maintenance and repair, observation, and research much more than piloting, which was limited to docking, undocking, and keeping the station in correct attitude. Although pilots were traditionally appointed mission commanders, flight engineers began demanding more authority in decision making. The engineer-cosmonaut Georgii Grechko summed up the engineers' sentiment as follows: "The time of pilots among cosmonauts is passing. In any case, they are no longer the main agents of the exploration of the Universe. 'Our' era, the era of flight engineers is dawning." Grechko's discussion of these controversial issues with his commander, the pilot Iurii Romanenko, during their mission on the Salyut 6 station quickly turned into a heated argument. Eventually, Grechko had to flee into another compartment of the station to avoid violent confrontation.[119]

Maintaining a complex orbital station with its long-term life support systems devoured most of the cosmonauts' time on board, raising questions about the relative costs and benefits of human flight. The engineer-cosmonaut Valentin Lebedev calculated that during a five-day work week, two cosmonauts spent 111 hours on supporting themselves, with only nine hours left for scientific research. "The station is crewed just for the sake of those nine hours," lamented Lebedev.[120] In an interview given after his retirement, Mishin similarly estimated that most of a cosmonaut's time on board was spent on preparations for takeoff and landing, on physical exercise, and on sleep: "Only 20 percent of a cosmonaut's time was spent on really productive work." He concluded that the cosmonaut profession did not exist and that, at present, piloted flights were "entirely unnecessary."[121]

Feoktistov proposed to solve the problem of inefficiency of human spaceflight though automation. "A man assigned to cope only with control functions is an unjustifiable luxury," he argued. "No craft is designed to carry dead weight. It must have a payload that performs a kind of useful work. This can

be, for example, research." He proposed to make spacecraft control "simple and executable without high skills and during a minimum time" to allow scientists and engineers to fly space missions. "Every operation that can be automated on board a spaceship should be automated," concluded Feoktistov.[122]

Chertok similarly viewed automation as a way to free up the crew from routine functions: "I, in particular, thought that the degree of automated control that was already on *Vostoks* was even better on *Zenits*; and this better degree of control would be absolutely marvelous on the next generation of spacecraft. Therefore I thought that the crew should conduct research, intelligence gathering, and experiments."[123] Feoktistov argued that valuable scientific data could be obtained only if scientists were included in space crews. "Scientists can develop their own experimental agenda, prepare their own instruments and equipment. . . . Cosmonauts [who lack scientific training] do not have this expertise. They are trained for specific mechanical operations: to turn something on, to switch something off, to monitor equipment, etc. If scientists come to space, scientific research would be more productive."[124]

Long debates over the question whether scientists should be allowed on board were resolved in favor of a "professional cosmonaut," an engineer or a pilot, who would receive some scientific training and conduct experiments on board in consultation with scientists on the ground. The most the scientists were able to achieve was the privilege of direct communication with the cosmonauts in orbit.[125]

The problem of professional identity of the cosmonaut—a pilot, an engineer, or a scientist—proved inextricably linked with the question of onboard automation. If the first cosmonaut pilots tried to wrestle control functions from the machine, later on, cosmonaut researchers preferred to delegate equipment service functions to automatic systems to free up their own time for experiments and observations. As Lebedev put it, "Man is not an appendix to a machine. Man is not made for the flight, but the flight is made for man."[126]

AUTOMATION IN CONTEXT

This brief overview of human-machine issues in the Soviet space program indicates that instead of the binary opposition of manual versus automatic control, we encounter complex human-machine systems, in which both humans and machines depend on one another; manual and automatic functions are not necessarily fixed but may be redefined during the flight, and human-machine interaction on board becomes part of a vast remote-control network. "Automatic" control operations have some degree of human input, and "manual" control is always mediated by technology. Determining how these lines are negotiated in specific instances provides a glimpse into the internal politics and professional cultures within the space program.

Onboard automation was both an instrument and a product of local politics in the Soviet space program. The debates over the proper degree of automation were tied to the definition of cosmonauts as either pilots or engineers. Here, technology, professional identity, and social status were closely intertwined.

The existing historiography largely interprets the Soviet approach to human-machine issues as complete reliance on automation. This view misses several important aspects of the story. First, it downplays the intensity of internal debates over the role of the cosmonaut on board. Engineers with their technical notions of reliability, cosmonauts with their piloting aspirations, human engineering specialists with their formulas for optimal division of function between human and machine, industry executives with their aversion to risk taking, political leaders with their sober calculations of political gains and risks—all had their input in these disputes. The Soviet approach to onboard automation did not appear to have been predetermined; it was developed, refined, and often reshaped in the course of these debates.

The Soviet approach evolved over time, from the fully automated equipment of *Vostok* to the semiautomatic analogue control loops of *Soyuz* to the digital systems of *Soyuz T* and later generations of spacecraft. The role of the cosmonaut also changed, from the equipment monitor and backup on *Vostok* to the versatile technician on *Soyuz* to a systems integrator on later missions. The Soviet approach also changed across various space projects running in parallel. In the late 1960s, while *Soyuz* was still largely controlled by onboard automatics or by ground operators, the Soviet lunar ships were designed to give the crews a much higher level of autonomy and control over their missions.

The Soviet approach was also uncertain in another sense: the division of function between human and machine was not totally predetermined but was often renegotiated during the flight. Ground flight controllers played a crucial role in deciding whether the crew would be allowed to use manual control. It is important, therefore, to examine not just the division of technical functions but also the division of authority between the human on the ground and the human on board.

ASTRONAUTS AND COSMONAUTS: THE SAME PROFESSION?

The issue of automation proved essential to shaping the identity of the American astronaut as much as the Soviet cosmonaut. Historian Matthew Hersch has applied the sober, decidedly unsentimental, and almost brutally incisive analytical framework of labor conflict and professionalization to trace the formation of the astronaut corps and its role in the U.S. space program.[127] He has shown that a whole range of issues negotiated within NASA—from

the criteria for astronaut selection, to the degree of spacecraft automation, to crewing decisions, to mission programming—was loaded with interests of various professional groups: test pilots, military pilots, scientists, engineers, and managers. At the core of these debates lay a series of clashes among different professional cultures, each competing for influence within the U.S. space program.

Unlike the first Soviet cosmonauts, who were selected from among junior military pilots and whose identity was kept secret until their flights, the first American astronauts were well-educated, experienced, elite test pilots who became celebrities well before they flew into space. While the cosmonauts found themselves almost completely at the mercy of powerful space engineers, the astronauts skillfully used their symbolic capital to gain influence in various aspects of the U.S. human-spaceflight program, from crewing decisions to spacecraft design. Although the cosmonauts and the astronauts seemed to fit into the same occupational niche, their *professions*, emerging in different sociocultural contexts, showed remarkable differences.

A series of social and cultural tensions shaped the profession of the American astronaut. The first astronauts had to navigate between NASA's engineering corps, which favored reliable automation, and the test pilot community, which placed the highest value on superb piloting skills. The astronauts were able to carve out a professional role for themselves, which combined high technical expertise with manual piloting and backup options at crucial phases of flight. Later on, the arrival of scientist-astronauts and military pilots challenged the dominant status and cultural norms of pilot-astronauts. In response, the pilot-astronauts hardened their stance, marginalizing the other groups within the astronaut corps. As a result of such labor disputes, the research component of the Apollo and Skylab programs got a short shrift.

The Soviet human-spaceflight program experienced many of the same tensions, opening an even larger gap between the professional identity and the public image of the cosmonaut. The complex organizational structure of the Soviet space program, lacking the unifying administrative force of NASA, produced a fractured cosmonaut corps, with different cosmonaut groups associated with different powerful organizations in the space industry and in the Air Force. As the result of an uneasy compromise, the cosmonaut corps essentially divided into two main specialties—the pilots and the flight engineers—instead of forming a single profession with a diverse set of skills.

6 THE HUMAN INSIDE A PROPAGANDA MACHINE

The Public Image and Professional Identity of Soviet Cosmonauts

ON April 11, 1961, as Nikita Khrushchev was resting in his vacation residence at the Black Sea resort of Pitsunda, he received a telephone call. A high-ranking government official in charge of the defense industry called to report on the impending launch of the first piloted spacecraft with cosmonaut Yuri Gagarin the very next day. Just a few days earlier, on April 3, Khrushchev had chaired a meeting of the Presidium of the Party Central Committee, which approved the launch but did not set a specific date. Now the date was set, and Khrushchev began to think ahead about the postflight publicity that this event deserved. He turned down the suggestion to bring Gagarin to Pitsunda after the completion of his mission. Khrushchev reasoned that this would look like a private event, and he wanted a spectacular public ceremony. He proposed instead that he would fly back to Moscow, greet Gagarin at Vnukovo Airport with "as much magnificence as possible: radio, television, and brief speeches," and then bring Gagarin to the Kremlin for a grand reception. Khrushchev also proposed organizing a welcoming mass rally on Red Square by assigning a specific quota of participants to various Moscow factories and institutions. Initially Khrushchev thought that the Red Square rally might pass without speeches, but an official joint resolution of the Party and the government issued the next day specified a full-fledged public ritual with appropriate speeches.[1]

Organizing "spontaneous" collective expressions of public enthusiasm was

routine Soviet practice. When foreign dignitaries arrived in Moscow, people lined the streets, greeting them with flowers and waving flags. To ensure that an adequate number of enthusiastic citizens would show up, the authorities assigned fixed segments of every street along the route to local industrial enterprises and institutions, which were responsible for hoarding their employees and "covering" a specific section between two designated lampposts. Employees, for their part, often viewed a daytime walk to their familiar lampposts as a welcome diversion from routine work duties.[2] But the reception of the first cosmonauts turned out to be quite different. Instead of trying to induce public sentiment, the authorities faced the problem of containing the mass outpouring of emotions.

On April 14, as the plane carrying Gagarin flew over Moscow, the cosmonaut saw thousands of people flooding the streets and squares of the capital. As soon as the plane touched down, a military brass band began to play the "Aviation March": "Ever higher, and higher, and higher we direct the flight of our birds." The song had been very popular in the 1930s, as part of the Stalin-era "aviation culture."[3] The public ceremony of Gagarin's welcome evoked the mass celebrations of Soviet aviators' feats in the 1930s. The new Soviet hero—the cosmonaut—took the baton from Stalin-era aviation idols and carried it ever higher.

Red Square could not contain all who came to celebrate. The government had planned a 200,000-strong rally and distributed the requisite number of passes to the square. Yet thousands of people without passes crowded the neighboring streets.[4] After the rally, Khrushchev hosted a lavish reception at the Kremlin for fifteen hundred people, including the entire foreign press and diplomatic corps. At the reception Gagarin thanked the Party, the government, and the people. He toasted to the Soviet people, Lenin's Party, and Khrushchev's health. The text of the toast had been approved in advance by the Presidium of the Party Central Committee.[5]

After the Kremlin ceremony, Gagarin's life changed forever. A young lieutenant whose name had been known only to a tiny group of cosmonaut trainers and space engineers instantaneously turned into a world celebrity. Barely hiding his embarrassment, Gagarin told his wife, "You know, Valyusha, I did not even imagine such a welcome. I thought I'd fly and then come back. But I did not anticipate this."[6] He did not fully realize the extent of the transformation yet. From that moment on, Gagarin became a symbol, and despite his hopes and efforts to the contrary, his whole life was now dedicated to a single goal: to fulfill this symbolic function well.

The Soviet Union's wide use of its technological achievements in space exploration for propaganda purposes is well documented in the political and cultural histories of the period. Groomed by the Soviet political leadership to

serve as ideological icons of communism, the cosmonauts presented a public face of the Soviet regime. The cosmonauts toured the entire world, reinforcing political ties with the socialist bloc, agitating for communism in the Third World, and showcasing Soviet achievements in the West. Inside the country cosmonauts served as a symbol of the New Soviet Man—a true believer in communist values and a conscientious builder of the bright future. The cosmonauts played an important role in campaigns for atheism and scientific education. They also symbolized the superiority of Soviet rocketry, whose "display value" underscored the might of the Soviet Union as a nuclear superpower.[7] The cosmonaut myth was not about their actions in orbit or the technical aspects of spaceflight but about the Soviet state. As historian Cathleen Lewis has noted: "Spaceflight was merely an attention grabbing method with which they could gain worldwide notice."[8]

The popular image of the cosmonauts was full of internal contradictions. Their flights were praised as daring feats, while official reports of perfectly functioning onboard automatics did not seem to leave much room for human action. Soviet space technology was hailed as infallible, thus seemingly eliminating any element of danger from spaceflight. The role of a public hero whose mission did not look very risky was uncomfortable for the cosmonauts, who knew full well the real hazards of their flights but could not talk about them.

The cosmonauts found it increasingly difficult to reconcile their professional self with the idealized public image attached to them. Trained as military pilots or engineers, the cosmonauts were often unprepared for their assigned public roles. They preferred training for new spaceflights over going on exhausting political speech circuits. Yet their public persona had little to do with their professional skills.

This chapter focuses on the interplay between the cosmonaut image in Soviet propaganda and the professional culture of Soviet cosmonautics. Instead of being a perfect display model for Soviet society, the cosmonaut myth reflected genuine contradictions and tensions in Soviet politics and culture. The question of how to fit the cosmonaut into an automated spacecraft sparked an internal debate over the cosmonaut's professional role.[9] A similar controversy was generated by the attempts to fit the cosmonaut into the Soviet propaganda machine.[10]

THE MAKING OF A LIVING SYMBOL

In the first half of the 1960s, the Soviet space program boasted one spectacular success after another—the first man's flight, the first daylong mission, the first group flight, the first woman's flight, the first multicrew mission, and the first space walk. The names and faces of the first eleven cosmonauts were familiar to any Soviet citizen who read newspapers, listened to the radio, or

went to movie theaters. The myth of the cosmonaut—a perfect hero conquering outer space with flawless technology—fed from and sustained a larger political myth of the Soviet Union as a mighty superpower that produced perfect heroes and created flawless technology.

For many people around the world, the cosmonauts—young, energetic, good-looking masters of cutting-edge technology—became a living embodiment of the bright, promising future. The Party leadership, however, wanted to make the cosmonauts into a very specific symbol—an emblem of the communist dream come true. Just a few months after Gagarin's and Titov's historic flights, the two cosmonauts were to appear at the Twenty-Second Party Congress in Moscow and to serve as living representations of the New Soviet Man, to be imitated by the Soviet youth. In August 1962 Khrushchev publicly proclaimed that "hero-cosmonauts are people who even now already embody the wonderful traits of the member of the communist society—high intellectual culture, moral purity, and perfect physique. Their deeds are driven by the love for Motherland, sense of public duty, and noble ideals of communism."[11]

The first group of cosmonauts—twenty young fighter pilots—all had similar social and professional backgrounds. Born—with a few exceptions—between 1933 and 1935, they witnessed the horrors of World War II but were too young to participate in the war. A few, like Gagarin, lived under Nazi occupation. Many, like Gagarin, came from peasant families and had modest schooling. Most went to a military aviation school right after graduating from high school. By the end of 1959, when they were selected into the cosmonaut corps, most of these young men had served in the Air Force as fighter pilots for only two to three years and had the rank of senior lieutenant. Only two had graduated from Air Force academies; just one had some training as a test engineer. Most cosmonaut trainees had little flying experience. Gagarin, for example, accrued only 230 hours of flight time. Sixteen out of twenty were ethnic Russians. After the Ukrainian Vladimir Bondarenko died in an accident and the Tatar Mars Rafikov was expelled from the corps for misconduct, only two non-Russians remained in the group.[12] Major General Leonid Goregliad, who participated in the cosmonaut selection, remarked that for all cosmonauts, the life story was the same.[13]

Turning a group of young pilots, inexperienced in public relations, into professional spokespersons for communism required a serious effort. As the Cosmonaut No. 2, Gherman Titov, later confessed, he was "very afraid of journalists. After all, we were trained to fly into space, not to speak at various official or improvised press conferences."[14] Lieutenant General Nikolai Kamanin carefully scripted cosmonauts' behavior at public events. In particular, Kamanin carefully staged Gagarin's first public appearance before the Soviet leadership at Vnukovo Airport and wrote the sixty-six-word-long re-

port that Gagarin would recite to Khrushchev. Kamanin and Gagarin spent thirty minutes rehearsing it. Kamanin was satisfied with the training, noting self-contentedly that he had seen an oratory potential in Gagarin even before the flight.[15]

Kamanin used his experience of being a cultural icon of the Stalin era as a model for his efforts to shape the cosmonauts' public personas.[16] A famous Soviet aviator and a decorated air corps commander during World War II, Kamanin served after the war as air army commander and first deputy to the Air Force chief of staff. In 1960 he was appointed deputy Air Force Chief of Staff for combat training for space. Kamanin oversaw the Cosmonaut Training Center and represented the Air Force in all negotiations over crew selection and responsibilities in flight. An unabashed Stalinist, he ruled the cosmonaut corps with an iron fist, demanding strict discipline and implicit obedience and severely punishing any transgressors, up to the expulsion from the corps. The cosmonauts, whose chances for future flights depended heavily on Kamanin's favor, were terrified of him.[17]

Kamanin's goals did not always perfectly align with the objectives of Khrushchev's propaganda apparatus. Outraged by Khrushchev's denunciation of Stalin and by the vociferous campaigns glorifying Khrushchev's personal accomplishments, Kamanin had little sympathy for official political rhetoric. He knew how to pay lip service to the Party line but was adamant in pursuing his own priority—boosting government support for human spaceflight. Rather than following orders from above, Kamanin often put forward new propaganda initiatives. When his military superiors vetoed his proposal to declare April 12 (Gagarin's flight anniversary) an official Cosmonautics Day, he petitioned the Party Central Committee over their heads. Kamanin arranged for Titov to sign the petition, thus adding the cosmonaut's political weight to the proposal, which was accepted.[18] While the Soviet leadership exploited space spectaculars for their political ends, Kamanin and other leaders of the space program skillfully manipulated the symbolic capital at their disposal to elicit much-needed support for the space program from Party bosses.

Space propaganda thus had a dual face. It conveyed political and ideological messages to the masses and at the same time boosted the legitimacy of spaceflight as an indispensable component of the construction of communism. The new Party program proclaimed that "the first triumphal orbitings of the globe, accomplished by Soviet citizens . . . have become symbols of the creative energy of ascendant Communism."[19] This not only adorned the image of communism with space symbolism but also asserted the highest ideological value of space exploration and thus ensured sustained government support for human spaceflight. The declaration of April 12 as Cosmonautics Day effectively mobilized the Party and government apparatus in the service of space propa-

FIGURE 6.1. Cosmonauts Alley in Moscow, unveiled in 1967. Cosmonauts' busts, left to right: Yuri Gagarin (sculptor Lev Kerbel'), Valentina Tereshkova (sculptor Grigorii Postnikov), Pavel Beliaev (sculptor Andrei Fandysh-Krandievskii), Aleksei Leonov (sculptor Andrei Fandysh-Krandievskii), and Vladimir Komarov (sculptor Pavel Bondarenko). Image courtesy of Aleksandr Litvak.

ganda. Party and government bureaucrats now arranged lectures about Soviet space achievements at factories, collective farms, and military units; the radio and television broadcasted numerous meetings and concerts on space themes; news agencies distributed reports and visual materials; political and literary magazines published special issues; movie studios created films about cosmonauts; and sculptors erected monuments to Soviet space triumphs.[20]

Kamanin skillfully controlled access to cosmonauts and their public image. He signed off on publications about their lives, managed their schedules, and gave permissions for interviews.[21] He even critiqued the work of the sculptor Grigorii Postnikov, who created cosmonauts' busts for public display. Kamanin approved Postnikov's portrayal of Gagarin, Nikolaev, Popovich, and Tereshkova but found fault with the depictions of Titov and Valerii Bykovskii.[22]

Soviet media gradually shaped a canon of visual representation of cosmonauts. Illustrated magazines, such as *Ogonek*, featured the same types of photographs for every new cosmonaut hero: the hero looking at his or her

photograph on the first page of *Pravda*; the hero speaking on the phone to the Soviet leadership, informing them of the successful flight and thanking for the Party's loving care; a ritual welcome at the airport; the hero in childhood; the hero in training, preparing for the flight; the hero among friends, fishing, or playing chess; the hero among the family, embracing children; and so on. By showing the cosmonauts in everyday situations, the photographs emphasized that heroic deeds were accomplished by ordinary Soviet people. The cosmonauts were not supermen; they symbolized the progress of all Soviet people toward the New Soviet Man, the dedicated builder of communism.[23]

As living symbols, the cosmonauts had to comply with their prescribed image around the clock. A formal set of rules regulated cosmonauts' daily life. Cosmonauts had to inform their superiors about their whereabouts every time they left the Cosmonaut Training Center. They had to refrain from alcohol and go to bed at 11 pm, even if they were on vacation. The authorities often forbade cosmonauts to go on private trips (for example, to a friend's wedding). Cosmonauts even had to ask permission to take their children with them on vacation. Cosmonauts' appearance also became the subject of strict regulation. When Titov appeared unshaven in interview footage, Kamanin suggested that the interview be cut from a documentary about the *Voskhod* mission.[24]

Kamanin took upon himself not only the formal supervision of the cosmonauts' selection and training but also their moral upbringing. He did not spare any effort to make the flown cosmonauts conform to their public image as exemplary Soviet citizens, scolding them for marital troubles and withholding their promotion in rank for drunk driving incidents. Kamanin treated the cosmonaut trainees even harsher, expelling several of them from the corps for drinking and insubordination. Rules for cosmonauts' behavior during their trips abroad were much stricter than inside the country, because any incident would be immediately publicized, and damage control would be more difficult. On all foreign trips, the cosmonauts were accompanied by KGB minders. Although KGB personnel were routinely attached to Soviet delegations going abroad, in this case their functions were broader. They not only watched the behavior of the cosmonauts but also were on the lookout to prevent any "ideological provocations," such as an attempt to photograph a cosmonaut with a bottle of Coca Cola in the background.[25] Once Tereshkova's minder had left her to the care of a Soviet ambassador's wife for a few hours, and Kamanin was outraged; apparently the KGB watch was to be maintained around the clock.[26]

For every trip the Party Central Committee issued specific behavior guidelines and talking points for the cosmonauts. Kamanin himself drafted those guidelines and, after they were approved by the Party authorities, was

obligated to enforce his own instructions. For example, when the cosmonauts Beliaev and Leonov were sent to the 1965 International Astronautics Congress in Athens, Greece, Kamanin told them to act toward American astronauts "in a friendly manner, but without praise" and to keep their relationships with the German American rocket designer Wernher von Braun "polite but strictly official." Kamanin eliminated shopping from cosmonauts' trip schedules, on the ground that this would "belittle" them. When foreign media reported that Gagarin had received a sports car as a gift from the French, the Party secretary for ideology, Mikhail Suslov, became concerned and advised cosmonauts to be "careful" about accepting gifts from the capitalists' hands.[27]

Kamanin carefully crafted cosmonauts' speeches abroad, trying to reconcile contradictory expectations. While Soviet officials insisted on political propaganda, the locals wanted to see a cosmonaut and not an overt political agitator. Kamanin privately remarked, for example, that in his speeches in India Gagarin "delved into politics more than he should" and put too much stress on communist ideology. This probably alienated some local politicians, who began limiting Gagarin's public appearances. Kamanin then advised Gagarin to stick to the basic message of world peace and cooperation in space. Kamanin also pointed out to Popovich that some statements he had made on Cuba were indiscrete. Popovich had said, "We will help Cuba not only here on Earth, but from outer space as well," which had sounded like a veiled military threat. Popovich had also hinted that the Soviet Union was about to launch a woman cosmonaut, which was still a state secret. On another occasion, Kamanin admonished Leonov for saying that "people in Greece welcomed us even warmer than in socialist countries." The warmth of reception was seen as a political indicator, and it had to correspond to the strength of the country's political ties to the Soviet Union. Cosmonauts needed to learn the ropes of public political speech. Kamanin insisted that they had to visit two or three socialist countries before they could be trusted to go on a more challenging mission to the Third World, not to mention the capitalist inferno.[28]

Kamanin made a determined effort to turn former fighter pilots into public figures, skilled at oratory and adept at political language. Political education was made part of the formal curriculum. The first group of six candidate cosmonauts, including Gagarin, received forty-six hours of instruction in Marxism-Leninism, which amounted to 8 percent of their total training time.[29] Under Kamanin's supervision the Cosmonaut Training Center introduced a program of enculturation to broaden the fighter pilots' intellectual horizons. The cosmonauts went on group trips to museums, art galleries, and historic sites, visited the Bolshoi and other theaters, and attended concerts by performers from Czechoslovakia, Cuba, and the United States. They listened to lectures about ancient Greece and Rome, the Renaissance men, Peter the

Great, and famous Russian painters and opera singers.[30] The chief of the Air Force Marshal Konstantin Vershinin, who often felt embarrassed at meetings with foreign dignitaries because of the lack of knowledge of foreign languages, instructed Kamanin to make sure that all cosmonauts become fluent in English.[31] The cosmonauts were even given copies of the Bible—which were hard to come by in the Soviet Union—in order to dispel their ignorance about religion and to better equip them for disputes during propaganda tours.[32]

Cosmonauts' "private" lives were by no means private. Kamanin insisted that Gagarin and Titov treat their wives with greater respect. In a domestic dispute between Popovich and his wife Marina, Kamanin took the side of the cosmonaut and suggested that Marina, an ace pilot, should quit flying and devote more time to her husband and daughter—a proposal that made Popovich quite uncomfortable. Kamanin took a special interest in the marital plans of Nikolaev, the only bachelor in the first cosmonaut group, and even introduced him to the daughter of the Soviet minister of defense Rodion Malinovskii, hinting that a marriage to her might prove "useful for cosmonautics." When Nikolaev's affections turned to Tereshkova, however, Kamanin quickly realized that their marriage would also be "useful for politics and for science," even though he had strong doubts about their match. In October 1963 he urged Nikolaev to hurry up with a proposal, as Nikolaev and Tereshkova were already invited to visit Hungary together in December, on the assumption that they would have got married by then. Kamanin even suggested setting the wedding day in late October or early November to avoid conflict with their foreign trip schedule. Finally the date of November 3 was set by a formal decision of the Party leadership. Kamanin suggested that "the wedding cannot be just a family affair, since the entire world is interested." Two hundred people were invited to a government-sponsored banquet; Kamanin handled the invitations. The newlyweds spent their honeymoon on a propaganda trip to India.[33]

Kamanin perhaps felt the right to pressure Tereshkova because her selection as the first female cosmonaut ahead of more qualified candidates was apparently motivated by propaganda needs. Even though other candidates, according to Kamanin, were better prepared for the mission than Tereshkova, they "would never be able to compete with her in the skill of influencing the crowd, in the ability to attract warm sympathies of people, or in the readiness to speak well before any audience. These qualities of Tereshkova determined her selection as the first female cosmonaut."[34] Tereshkova's ability to represent the New Soviet Woman proved more important than her professional skills. Soviet educators' efforts to use Tereshkova's image to promote Soviet girls' interest in science and engineering proved quite successful, though short-lived.[35]

Tirelessly rehearsing with cosmonauts their speeches, editing their mem-

oirs, monitoring their private lives, and guiding their careers, Kamanin was more than anyone responsible for shaping both the cosmonauts' self and their public image. He was quite justified in his confession in a diary that "it was I who created Tereshkova as the most famous woman in the world."[36]

Among the public duties assigned to the first cosmonauts after their widely publicized flights was service as members of the USSR Supreme Soviet or regional legislatures, usually representing their hometown and the surrounding district.[37] Though the election of cosmonauts served largely to legitimize these ceremonial quasi-parliamentary bodies, routinely rubber-stamping the decisions of the Party and of the Council of Ministers, for cosmonauts themselves this was not a purely formal duty. They received hundreds of complaints about local injustices from their constituents and had to navigate the complicated world of Soviet bureaucracy, trying to help their voters. Even if they themselves led privileged lives, procuring food and clothing through special channels and regularly traveling abroad, they were not completely isolated from the concerns of ordinary citizens. This affected their outlook and heightened the tension between their propaganda mission and the knowledge of Soviet reality.

Membership in the Supreme Soviet brought to cosmonauts not only new burdens but also some perks and tangible levers of influence. It opened for them the doors of high Soviet officials and gave the cosmonauts, relatively low-ranking military officers, the formal credentials of elite status. By integrating into the ruling class, the cosmonauts effectively translated their celebrity status into positions of real power.

Having gained the status of political elite because of their accomplishments in space, the cosmonauts remained dependent on their military superiors to maintain this status. As public figures, the cosmonauts might sit in the parliament and decide the matters of state, but as members of the cosmonaut corps they were strictly subordinated to their Air Force superiors. Even after the cosmonauts were elected members of the Supreme Soviet, Kamanin continued managing their schedules, deciding when and with whom they would be allowed to meet and which assemblies to attend. He used membership in the Supreme Soviet as a carrot he could give or take away, depending on a cosmonaut's performance. In 1964, when Titov got carried away with his new celebrity status and went on a spree of drunk driving incidents and clashes with police, Kamanin sternly reprimanded him, threatening to strip him of his membership in the Party and in the Supreme Soviet, and to cancel other cushy appointments. At that time, Titov did keep his position in the parliament, but Kamanin forbade him to speak publicly and to attend receptions. In 1970, having lost patience with Titov, Kamanin canceled his reelection and wrote in his diary that Titov would "never be a deputy again."[38] Indeed, Titov

would not occupy an elected office until the collapse of the Soviet Union. The cosmonauts' professional status clearly dominated over their public personas; they were allowed to function as public figures only as long as they maintained their good standing as professional cosmonauts.

Cosmonauts could not express themselves in their own words: Kamanin wrote their speeches, and journalists drafted their articles and memoirs. Cosmonauts spoke other people's thoughts and copied other people's texts in their own hand before submitting them for publication to preserve the appearance of authorship. Tereshkova pointed out to Kamanin that her ghost-written memoir tells a story of her long-held dreams of space, while in fact the idea of becoming a cosmonaut had not crossed her mind before she was invited to take part in candidate selection tests. Kamanin acknowledged that a journalistic account followed stereotypes and had many discrepancies but it was too late to make any corrections if the book was to be released by the third anniversary of Gagarin's flight.[39]

Kamanin's energetic efforts to publicize the lives of cosmonauts caused discomfort for his military superiors and ideological watchdogs, who were losing control over space propaganda discourse. In 1963 the KGB and the General Staff raised concerns about possible disclosure of state secrets, in particular, about cosmonaut training methods. Kamanin had to ban access to the Cosmonaut Training Center for journalists, photographers, and movie producers and to start producing publicity materials by the center's staff.[40]

Soviet media coverage of space, pushed by secrecy restrictions and pulled by propaganda agenda, resorted to a set of clichéd stories: faultless cosmonauts flew perfect missions, supported by unfailing technology. Just as the journalists struggled to create a coherent public image of spaceflight—flawless yet heroic and dangerous—so the idealized public image of cosmonauts was also ambivalent. On the one hand, the cosmonauts were portrayed as exceptional human beings, glorifying the Motherland with their heroic deeds. On the other, the media stressed that the cosmonauts were just like ordinary people—coming from a humble background, living regular family lives, and pursuing usual pastimes—and thus embodying the very spirit of the Soviet people.

The Gagarin cult set an exemplar for such centaur-like exceptional-ordinary public imagery. As Golovanov has noted, "most studies of Gagarin drive a stubborn idea of Gagarin's exceptionalism and at the same time stress that Gagarin apparently did not distinguish himself among others or 'push' others by the force of his personality; he was 'like everyone else.'"[41] One sympathetic Indian journalist described Gagarin as "normal to the point of abnormality."[42] Gagarin fully shared the experiences and feelings of his cohort.

"For all of us, Yuri [Gagarin] personified the whole generation of Soviet people, whose childhood was singed by the war," recalled one cosmonaut.[43] Even Kamanin called him "the most normal of the normal."[44]

Gagarin's natural charisma, geniality, and openness began to shape a new image of the Soviet man abroad. The old imagery—the menacing-looking dictator Stalin, the dogmatic Party bureaucrat, and the stern Soviet soldier—was replaced by this cheerful and charming young man. "The first cosmonaut was chosen ideally to represent the Soviet man before the nations of the entire world. His perfect features, pleasant look, his charming smile and even his short height, which stresses his youthful stature—everything makes the most favorable impression on anyone who met him, saw him in cinema or on television," raved the Indian journalist. "The almost mythical idea of the Soviet man became reality for the people of the world in this unusually humane, modest, and agreeable image of Yuri Gagarin. They can see now that he is an attractive young man, an exemplary son, a devoted husband, a cultured man who loves to read good books and listen to good music. The fact that he is a communist does not mean that he is intolerant toward those who disagree with his ideology, and it does not mean that he lacks the sense of humor."[45] It was the human side of Gagarin, rather than his idealized propaganda image, that endeared him to millions of people around the world.

In his recent biography of Gagarin, historian Andrew Jenks suggests that the roots of the popular fascination with Gagarin lay in "Khrushchev-era fantasies of escape from an imperfect and corrupted world. Many Soviets believed that the launching of man into space, like the coming of Christ, presaged the dawning of a new age—as if rockets could somehow liberate people from the constraints, cramped apartments, tedium, petty arguments, boring jobs, gritty poverty, and injustices of daily life." Jenks also stresses the tension between the image of Gagarin's honesty and moral purity, cultivated by Soviet propaganda, and Gagarin's private moral failings. The self-sacrificing rhetoric of heroism, surrounding popular representations of Gagarin's feat, further contrasts with the gradual "transformation of Gagarin into a consumable commodity," as the beloved hero began appearing on chocolate wrappers and in lifestyle photo sessions. Jenks describes the popular image of Gagarin in glossy magazines as "someone who combined selfless service to state and nation with the tireless pursuit of pleasure and leisure." Gagarin thus emerged as a "curious hybrid of the official Soviet hero and the modern celebrity," underscoring a fundamental contradiction in the Soviet propaganda discourse.[46]

Performing a spaceflight required a lot of courage, but facing worldwide fame presented an even greater challenge for the Soviet cosmonauts. This was something they were not trained to do, and it proved unexpectedly difficult.

THE BURDEN OF FAME

The Soviet government organized mass manifestations to celebrate space achievements in the same way all mass events were orchestrated. First, the number of attendees was set; usually 2,000 to 3,000 for the welcome ceremony at Vnukovo Airport and 60,000 to 200,000 for the rally on Red Square. Helicopters dropped leaflets, organizations received quotas for sending people to greet the cosmonauts along the route to Red Square, columns marched, leaders gave speeches, and music played. The day ended with a gala reception in the Kremlin for the select guests and with lavish fireworks for the masses.[47] "Although the new rituals were artificially designed," historian Richard Stites wrote, "many of them were sufficiently artful, emotional, and 'authentic'" to attract Soviet citizens.[48] Despite the thorough planning, the public outpouring of emotions seemed genuine. "At the dawn of the Space Age, people were coming out to greet cosmonauts on their own initiative," one memoirist has recalled.[49]

The eminent historian of Russian science, Loren R. Graham, then in his twenties, was among the ecstatic crowd on Red Square on April 14, 1961, celebrating Gagarin's triumph. He recalled that day as "the apogee in Soviet citizens' belief that they held the key to the future of civilization. The celebrations on the street were genuine and heartfelt. Soviet science was, they were sure, the best in the world, and Soviet rockets succeeded where American ones failed."[50]

Before the flight the cosmonauts' training was mostly technical, but postflight their activity was to a large extent political. Immediately after landing, the cosmonauts were thrust into a "swirl of receptions, trips around the world, and incessant speeches," as Feoktistov recalled.[51] Thousands of requests for interviews and invitations to visit various factories and institutions poured down on Kamanin, who oversaw the cosmonauts' schedules. The organizers of public events attempted desperately to lure in a cosmonaut or two, using all sorts of leverage on Kamanin, from his military superiors to the connections at the Party Central Committee. The military top brass liked to appear at public events accompanied by cosmonauts to bask in the space heroes' glory, and they often gave Kamanin direct orders to summon cosmonauts to serve as their entourage.[52]

Cosmonauts' private lives became subordinated to the demands of the propaganda machine. They were routinely recalled from their vacations to attend various public ceremonies in Moscow. No wonder cosmonauts soon began to complain to their superiors that they were "dead tired" of "meetings with the people." In September 1964 Kamanin wrote in his diary about his conversation with Bykovskii: "We understood each other without words.

Bykovskii has been going to receptions and meetings seven days in a row, and he is tired of this. He insisted on letting him do his regular job. I said, 'I know everything. If they send you again tomorrow, you can rebel, but today you must be at the House of Friendship to meet with a delegation from Finland.'"[53]

Kamanin tried to keep a lid on what he termed "partying and empty talk" and to allocate adequate time for cosmonauts' flight training and academic studies. The Air Force Engineering Academy, where cosmonauts studied, complained about their absenteeism, and cosmonauts repeatedly asked Kamanin to cut the number of ceremonial events at least during the final exams. Kamanin attempted to limit their public appearances to one or two per week, rejecting more than 90 percent of invitations. Turning down high-level requests became so routine that he even refused to allow the cosmonauts Nikolaev and Popovich to meet with the Party activists from the staff of the USSR Council of Ministers. The request was granted only after a threatening phone call from the Party Central Committee. From 1961 through 1970 the cosmonauts attended more than six thousand public events in the Soviet Union.[54]

Like any celebrity, cosmonauts soon grew tired of incessant public attention. It became impossible for them to show up in public without causing mayhem. In June 1962 Titov and his wife attended a popular music concert, but as soon as the audience learned that the cosmonaut was present, everybody stopped listening and started searching for him. When the concert ended, "the entire crowd rushed to the exit to see Gherman and his wife," recalled an eyewitness, a candidate cosmonaut. "The railing around a public garden miraculously held under pressure, and a reinforced police unit was able to restrain the excited mass of people for a few moments to give the Titovs an opportunity to jump into their black Volga and to escape the violent expression of universal love."[55]

When asked in an interview about his most difficult challenge, Gagarin unhesitatingly replied, "it is to carry the burden of fame."[56] He even compared this burden to the heavy g-loads he experienced during his spaceflight.[57] Yet Gagarin took his public mission seriously. He appreciated people spending hours in line to see him, and he patiently did his duty, giving speeches and signing autographs. He explained to his friends that this activity was necessary to establish a broad public support for the space enterprise: "A person would come home, show my autograph, and tell about meeting a cosmonaut. A conversation about cosmonautics in general would ensue, and such conversations add up to form a public opinion."[58]

Groomed by the Soviet political leadership to serve as ideological icons of communism, cosmonauts also toured the world, spreading the message of world peace, cooperation in space, and support for the communist cause. Within four months after completing his space mission, Gagarin visited

Brazil, Bulgaria, Canada, Cuba, Czechoslovakia, Finland, Great Britain, Hungary, and Iceland.[59] In 1961–62, he made twenty-two foreign trips.[60] In every country he visited Gagarin drew enormous crowds. In Calcutta, more than a million people gathered to see him, which prompted Kamanin to compare Gagarin to Jesus. Recalling in his diary that the crowd Jesus fed with five loaves of bread counted only five thousand, Kamanin concluded that Gagarin would be a clear winner.[61] On his trip to England in July 1961 Gagarin won universal admiration for his insistence on greeting the crowds in an open car under pouring rain. He reportedly said, "If all these people have turned out to welcome me and can stand in the rain, so can I."[62] As the number of invitations to visit foreign countries became overwhelming, Kamanin had to turn down more than two-thirds of invitations. Eventually the Soviet authorities introduced a complicated system, by which all cosmonauts' foreign trips had to be authorized by officials of the Party Central Committee. Due to the highest demand, Tereshkova's trips were decided by the top political authority, the Presidium of the Party Central Committee. All requests had to receive prior approval from the Ministry of Foreign Affairs, the Ministry of Defense, and the KGB.[63]

Cosmonauts' visits had a particular political importance in the Third World, where their public appearances were carefully planned to support pro-Soviet politicians. During a 1961 trip with his wife to India, Gagarin privately complained to Kamanin about the overloaded schedule: "Too much politics, and nothing for ourselves; we did not even see an elephant."[64] In the course of one day during his visit to Ceylon, for example, Gagarin traveled more than three hundred miles, visited nine towns, and gave more than fifteen speeches.[65] During his numerous foreign trips he endured nearly 150 days of such political marathons.[66] While diligently fulfilling his public responsibilities, Gagarin privately told Kamanin that he was "drained to the bottom."[67] Kamanin had to fight both Soviet ambassadors and local politicians, who pushed Gagarin to perform for fourteen hours a day. In his diary, Kamanin noted: "They do everything possible to squeeze out of Gagarin the maximum support for the government. They don't care how this would affect him."[68] Even in an open publication, Kamanin hinted at the problem: "Meetings and rallies follow one another; then come lectures and receptions. The sun is mercilessly burning. Sweat is covering the eyes. The feet are filling with lead. Yet Gagarin, excited and joyous, is standing in the human vortex and responding to greetings. Well, this is his duty."[69] After several years of incessant propaganda trips abroad Gagarin began to have nightmares: "Sometimes I close my eyes and see endless queues of people with blazing eyes, shouting greetings in foreign languages."[70]

Soviet officials viewed the reception of cosmonauts in various countries as

a litmus test of the political leanings of local politicians. Kamanin observed that Warsaw was the only capital of a socialist country that welcomed Soviet cosmonauts with portraits of both cosmonauts and American astronauts. He concluded that "Poland would easily enter into closer contact with the West at the expense of the interests of the Soviet Union."[71] Kamanin's deputy, who accompanied the cosmonaut Titov on a trip to Vietnam, noted that some prominent political leaders did not attend any of Titov's appearances and suggested that this might indicate a split in Vietnam's leadership.[72] While the Soviet government tried to use cosmonauts as "agitators for communism" and to improve the Soviet image around the world, local politicians often exploited the visits to boost their own public image. Cosmonauts were greeted with either excessive hospitality or ostentatious coldness, depending on local political rivalries and the relations between provincial elites and the federal government. If Soviet officials perceived that they were being taken advantage of, they tried to regain the initiative. When the local authorities in Bombay deliberately gave Gagarin's visit a low profile, the Soviet delegation immediately stirred public interest by announcing the visit route in local newspapers and thus attracted big crowds.[73]

The propaganda workload on the cosmonauts was enormous. From 1961 to 1970 the cosmonauts made two hundred trips abroad; Tereshkova alone made forty-two foreign trips. She received by far the most invitations among the cosmonauts. Kamanin noted that "nobody could match her ability to evoke warm sympathy of the people." Tereshkova's postflight propaganda activities tired her out much more than preflight training and the mission itself, making her increasingly irritable and lacking self-control. She was able to escape the political speech circuit only temporarily after becoming pregnant. Doctors forbade her to travel after February 15, 1964. Tereshkova was forced to do her propaganda job full-time almost to the last day: she returned from a propaganda trip to Africa on February 9. Her daughter was barely two months old, when Kamanin urged Tereshkova to attend a ceremony commemorating Aviation Day, arguing that it was "time for her to appear in public."[74]

Because of the shroud of secrecy that surrounded Soviet rocketry, the leading designers of spacecraft remained anonymous, and the media often presented human spaceflights as cosmonauts' personal achievements. Some cosmonauts felt it was not fair to focus the spotlight on them at the expense of all other participants in the space program. A few weeks after his flight, Gagarin wrote a confidential letter to the Chief Marshal of Aviation Aleksandr Novikov: "There is a lot being said and written around the world about this event [Gagarin's flight]. I do not feel that I can or have the right to accept all this on my own account. If my contribution amounted even to one percent of everything that is being said, this already would have been the greatest re-

ward for my deed. I know what our pilots had to endure during the Great Patriotic War. Their service and their hardships were so much greater than mine. I simply happened to be in the epicenter of events."[75] The more public praise Gagarin received, the more uncomfortable he became with his public image. "It is awkward to be seen as a super-ideal person," he later confessed. "It's as if I always did everything right. But, like anybody else, I make many mistakes. I have my weaknesses. One shouldn't idealize a person. One should take him just as he is in real life. It's annoying when I'm portrayed as a 'sugar boy,' who is so sweet that it's nauseating."[76]

More than anyone, Gagarin felt the pressure of the propaganda windmill that crushed his dreams for another flight and turned him into a calcified symbol. "Gagarin is still hoping that one day he would fly into space again. It is unlikely that this will ever happen; he is too valuable for the humanity to risk his life for an ordinary spaceflight," reasoned Kamanin. "I must try to convince him to give up flying and to prepare himself for the position of one of the leaders of the Soviet space program."[77] A leading space engineer who had many encounters with Gagarin remarked: "Gagarin understood full well that he would no longer be able to serve as an active cosmonaut, that he became a symbol. It was painful, and it made him depressed, and he could not restrain himself from longing for another flight. Just imagine a young, daring, venturesome Gagarin, who says happily 'Off we go!' and flies the first into space, and then, in a little while, he sees himself as a wax figure in a Madame Tussauds museum. This is an abomination. A normal man, full of life, cannot live like that; he would look for compensation."[78] And cosmonauts did look for compensation.

THE HUMAN SIDE OF A PUBLIC ICON

The cosmonauts faced an impossible task—to fit into their assigned image of "an ideal citizen of an ideal state."[79] Even though they were specifically selected to have qualities best matching their future public mission, the challenge of coping with the burden of fame proved too difficult for some. In 1961 Gagarin and Titov were elected delegates to the Twenty-Second Congress of the Communist Party. The congress would adopt a new Party program, which set a triple goal of creating a material and technical basis of communism, forming the new communist social relations, and bringing up the New Soviet Man. Gagarin and Titov were supposed to be in the Presidium of the Congress and to showcase the tangible achievements of the regime both in high technology and in the upbringing of the New Man. They were to illustrate the new "Moral Code of the Builder of Communism," with its calls for honesty, sincerity, moral purity, and modesty. A few days before the Congress, however, the plans went awry: Gagarin broke a facial bone when jumping out of the

window after what looked like a womanizing incident. Gagarin missed the opening of the Congress, and he and Titov were dropped from the presidium list.[80]

Once cosmonauts had flown their missions, they became celebrities and their lifestyle completely changed. Kamanin was showered with reports of their excessive drinking, drunk driving, and angry encounters with the police. The KGB submitted reports on cosmonauts' misbehavior directly to the Party Central Committee, which set up a commission to investigate the failure of the Cosmonaut Training Center's leadership to enforce discipline. The irony of the situation was that Party and government leaders themselves often invited cosmonauts to their private parties, where cosmonauts "got accustomed to drinking and became corrupted." Kamanin found himself between a rock and a hard place: he was reprimanded if cosmonauts misbehaved in public, but when he tried to limit cosmonauts' private contacts with the political elites to contain their "corrupting" influence, he also was in trouble. "The leadership of the country fusses over the cosmonauts like a child over a new toy and showers praise, promotions and invitations on them out of the horn of plenty," while he was expected "to keep the cosmonauts in check and to be held responsible if they drink too much at an official reception and say or do something inappropriate under influence," he remarked bitterly in his diary.[81]

The cosmonauts received substantial rewards and privileges, which placed them in the same bracket with the country's elite. Lieutenant General Kamanin's salary was only 15 percent higher than Major Gagarin's.[82] In addition to formal honors, the cosmonauts received handsome remuneration for completed spaceflights: a furnished luxury apartment, a luxury car, a two-year salary bonus, and a long list of gifts for their families—from vacuum cleaners to handkerchiefs.[83] A year of training in the cosmonaut group counted as three years of military service, and cosmonauts received accelerated promotions in rank. They received access to goods that were not available to ordinary Soviet citizens—for example, baby formula imported from Czechoslovakia and paid for in hard currency by special permission from the Ministry of Finance. The top brass of the Air Force and the Ministry of Defense grumbled about the cosmonauts' perks, which were decided at a higher political level. Kamanin privately suggested that the government's provisions gave the members of the cosmonaut group "so much material wealth and so many privileges that there is no motivation for them to fly to space, especially to fly the second time." He believed that an accelerated rise through the ranks could also be detrimental: "The character of most cosmonauts has not quite solidified, and this may damage it by planting the dubious notion that for them everything is permitted."[84]

As their popularity grew, it became increasingly difficult for Kamanin to control the cosmonauts' behavior. He bitterly complained in his diary that

"the cosmonauts overestimate the significance of their personal accomplishments and take at face value everything that is being written, said, and shown about every human spaceflight in the media."[85] Reinventing themselves to fit their iconic image, the cosmonauts seemed to gradually internalize their public personas, just as an ordinary Soviet citizen in the 1930s who had to hide undesirable social origins, assumed a false identity, and "began to feel that I was the man I had pretended to be."[86] The newly acquired celebrity image did not square well with the daily routine of spaceflight training and strict military discipline. The tension often resolved in violent outbursts.

Excessive drinking and regime violations plagued the cosmonaut corps. When a spree of drinking parties and auto accidents involving Titov culminated in the death of his passenger, Kamanin ran out of patience. He called a meeting of the cosmonaut group and told Titov in front of the whole gathering: "With your own misdeeds, you have put yourself outside the Party and outside the cosmonaut group. There is a strong cause for expelling you from the Party and depriving you of all your titles: a deputy, a Hero, a cosmonaut pilot, and a lieutenant colonel." But taking into account Titov's world fame, reasoned Kamanin, "Titov's disgrace would be a disgrace for all the cosmonauts, for all Soviet people. We cannot afford that." Titov received a strict reprimand, a demotion, and a temporary ban on public appearances, attending receptions, and driving a car, but his transgressions were kept under wraps, and he continued to represent the New Soviet Man in public. Leonov's drunk driving led to two serious accidents in four months, and Kamanin personally imposed a six-month ban on his driving. Popovich also got into trouble for drinking and brawling. He had to miss a session of the Twenty-Third Party Congress because of a black eye. Kamanin fired him from the position of deputy head of the cosmonaut team and suspended his training but did not object to electing Popovich a member of the Supreme Soviet.[87]

The attempts to make the cosmonauts into exemplary communists proceeded with considerable difficulty. They privately exchanged political jokes, such as the double-entendre slogan, "Officers of the Missile Forces, our target is communism!" Even some of their supervisors laughed at ideological clichés. One cosmonaut recalled that the deputy director of the Cosmonaut Training Center in charge of political education "understood everything, believed that the cosmonauts would not give him away, and did not make pretenses with us. . . . When asked 'How are things?' he invariably replied, 'Our country is on the rise.' If we mockingly asked 'And how is the Party?' he replied with an equal measure of irony, 'The Party teaches us that heated gases expand.'"[88]

Although cosmonauts were allowed some license in private jokes, any hint at serious political dissent was quickly suppressed. For example, at a political education session in early 1964 cosmonaut candidate Eduard Kugno raised

some controversial questions, such as "Why do we have only one political party?" and "Why do we send assistance to other countries, while there are shortages inside the country?" These questions were immediately reported to his superiors. Furthermore, when asked why he did not join the Communist Party, Kugno replied, "I will not join a party of swindlers and sycophants!" Kamanin quickly judged that Kugno was "ideologically and morally unstable" and expelled him from the cosmonaut corps.[89] Kamanin used even stronger expressions condemning the incompetence and corruption of the Soviet leadership in his diary, but he was outraged by Kugno's unwillingness to play by the rules and to restrict his remarks to the private sphere.

The supervisors' greatest fear was to see a flown cosmonaut use his or her celebrity status for a public expression of political dissent. When the deputy chief of the Air Force heard that two cosmonaut trainees had raised some criticism at a meeting at the Cosmonaut Training Center, he reacted at once: "Expel both. If they give such speeches while still on training, what will they say after returning from space?"[90] These fears were not entirely groundless. After returning from space, cosmonauts did use their newly acquired popularity in ways that did not always please their superiors.

COSMONAUTS SPEAK OUT

The cosmonauts found it difficult to reconcile their professional selves with the ideal public image assigned to them. Some of them felt uncomfortable about the unrestrained public praise and the monuments erected in their honor. Leonov, for example, defied a government decree and objected to the installation of his bust, which remained in the sculptor's studio for twenty-eight years.[91] The role of a public figure giving endless speeches did not appeal to the cosmonauts originally trained as fighter pilots. When meeting with American astronauts, the cosmonauts often forgot about their ideological mission and engaged in purely professional talk. Having met the astronaut John Glenn during his visit to the United States in 1962, Titov particularly remarked about Glenn's "tenacious professional gaze of the pilot" and admitted that when the cosmonaut and the astronaut met, they were "connected by everything they had experienced and lived through in space."[92]

Most cosmonauts preferred training for new spaceflights to public appearances. Gagarin, losing patience, once refused to meet with a television crew from East Germany and was reprimanded by Kamanin. Tereshkova resisted Kamanin's attempts to turn her into a professional politician. She even enrolled in the Air Force Engineering Academy, hoping to retain her qualifications for another spaceflight. Kamanin was convinced, however, that "Tereshkova as the head of a Soviet women's organization and of international women's organizations would do for our country and for our Party a thousand times

Figure 6.2. Monument to cosmonaut Aleksei Leonov in Kemerovo, unveiled in 2003. Sculptor Lev Kerbel'. Image courtesy of Egor Fidirko.

more than she can do in space."[93] Eventually he prevailed, and Tereshkova left the cosmonaut corps and served as the head of the Soviet Women's Committee for more than twenty years.

Gradually the cosmonauts developed an independent voice. They started by criticizing the harsh disciplinary regime at the Cosmonaut Training Center. In February 1963 they staged a "battle"—as Kamanin termed it—against the recently appointed head of the center Lieutenant General Mikhail Odintsov. A group of cosmonauts led by Gagarin organized a Party meeting, at which they complained about work overload and Odintsov's heavy-handed management style.[94] Kamanin eventually took the cosmonauts' side and, when Odintsov continued to ignore cosmonauts' critique, replaced him.

Soon cosmonauts moved on to more ambitious attempts to influence space policy on the government level. Mingling with the political elite at high-level receptions, cosmonauts enjoyed unique access to the Soviet leaders, which even their military superiors did not possess. In August 1965, after the successful completion of an impressive eight-day mission of *Gemini V*, Kamanin decided to petition the Soviet leadership for a fundamental change in the organization of the space program to catch up with the Americans. He realized that this proposal would be much more effective if it did not come from him but from the well-known flown cosmonauts. He persuaded Gagarin and five other cosmonauts to sign a letter, which Gagarin then passed on to Leonid Brezhnev's aide over the head of the cosmonauts' military superiors, thus clearly breaking subordination rules.[95] The letter warned that the Soviet Union was "losing its leading position" in space and pointed out the "many defects in planning, organization, and management" of the space program, such as the lack of planning of human spaceflight, the absence of a central agency responsible for space efforts, the "scattering of efforts and resources in space exploration," and the prevalence of policy decisions that "often reflect narrow departmental interests." The letter boldly accused the leadership of the Strategic Missile Forces, and even the minister of defense of insufficient support for the space program. The letter concluded with a suggestion to unify all military space affairs under the Air Force command, which would provide the basis for "thoughtful planning of space research."[96]

The cosmonauts' celebrity status gave them many privileges, but it did not translate into tangible political influence. Their letter ended up in the hands of the top leadership of the Ministry of Defense—the very people about whose indifference to the space affairs the cosmonauts complained. In November 1965 the Military-Engineering Panel of the Ministry of Defense discussed the issues raised in the cosmonauts' letter. Of all the cosmonauts only Gagarin was allowed to attend the meeting, and he was not given an opportunity to speak. Kamanin suspected that the military leadership was afraid of the cos-

monauts' frank and authoritative statements. As a result, Kamanin and the cosmonauts suffered a "crushing defeat." The cosmonauts never received a formal response to their letter from the Party authorities.[97]

Outraged by the lack of action on the matters raised in the letter, the cosmonauts decided to pursue a personal meeting with the Soviet political leadership. Kamanin advised them to "cool their heads" and to plan the next step very carefully.[98] Cosmonauts ignored his warning and asked the head of the KGB, Vladimir Semichastnyi, to arrange a meeting with Brezhnev. While the KGB was secretly monitoring cosmonauts' activities and submitting reports to the Party authorities, Semichastnyi privately mingled with the cosmonauts, and they felt confident that he would be friendly enough not to report them to their military superiors. The deal collapsed after Semichastnyi fell from grace and lost his position and influence.[99]

THE DECLINE OF THE COSMONAUT MYTH

The cosmonauts—professional fighter pilots—had to reinvent themselves to become public ambassadors, atheism lecturers, and political agitators. They had to assume a new public persona and to learn a new language of public speech, a Khrushchevian variant of Stalinist "Bolshevik."[100] Just like the "confidence men" of the 1930s, they had to pretend to be someone else, because their professional skills as cosmonauts were irrelevant to their public role. The constant tension between their professional identity as pilots and their public personas made the burden of fame suddenly showered on them even heavier. Strict discipline imposed on the cosmonaut corps clashed with the elite lifestyle they came to enjoy as world celebrities. The cosmonauts' role as a symbol of technological progress and bright future brought them popularity, but this popularity created temptations that seriously undermined their ability to represent moral perfection. Moreover, their public duties often interfered with their training for future flights. The better the cosmonauts fulfilled their symbolic roles, the more difficult it was for them to remain active cosmonauts.

Soviet aviation heroes of the Stalin era were not "merely passive symbols in the pantheon of Stalinist propaganda" but took active steps to define their own place in Stalinist culture.[101] Cosmonauts similarly attempted to break out of the assigned role and to use their celebrity status to take an active part in discussions of space policy. These attempts proved futile—not only because their fame did not translate into power but also because the Soviet Space Age was already passing its heyday, and they were losing their emblematic appeal.

In the second half of the 1960s, the string of space spectaculars gave way to a chain of setbacks and tragedies. In early 1966, Sergei Korolev—the legendary anonymous chief designer, an energetic and charismatic leader of the Soviet space program—suddenly died. His identity was finally disclosed and

his contributions widely honored. The focus of space myth making began to shift from the cosmonaut heroes to the engineering geniuses behind the miraculous rockets and spacecraft.[102] Yet the myth of flawless technology did not last long. In April 1967 the parachuting system of the new piloted spacecraft, *Soyuz 1*, malfunctioned, and its flight ended in a fiery crash and the death of cosmonaut Vladimir Komarov. The Soviet authorities had covered up the first casualty of the space program, the 1961 accidental death of cosmonaut candidate Vladimir Bondarenko during training, but Komarov's fate could not be concealed from the public. Komarov's death—one of the heroes of the 1964 *Voskhod* mission—shattered the myth of perfect reliability of Soviet space technology. In March 1968 the nation was shocked by the death of its most beloved hero, Yuri Gagarin, when his aircraft crashed during a training flight. Sad public rituals of state funerals took the place of the former mass celebrations of space triumphs.[103]

In the meantime, the Soviet secret human lunar program was floundering, as the giant new rocket N1 kept exploding at trial launches. These failures went unannounced, but it was difficult to keep from the public the news of the successes of the American lunar program—the circumlunar flight in 1968 and the lunar landing in 1969. The attempts to counter American lunar spectaculars with Soviet orbital missions proved futile. In October 1968, the cosmonaut Georgii Beregovoi misread signal lights and failed to perform a manual docking during his *Soyuz 3* flight. Though Beregovoi's return was greeted with usual fanfare, the public remained puzzled about his seemingly pointless mission. The successful *Soyuz 4/Soyuz 5* mission in January 1969 did not bring the expected propaganda dividends either. The crews showed tremendous courage and skill: Vladimir Shatalov performed the first manual docking of two piloted spacecraft, and Evgenii Khrunov and Aleksei Eliseev carried out a risky spacewalk from one spaceship to the other. Yet the mission almost ended tragically: a technical glitch resulted in a fiery descent and hard landing of *Soyuz 5*, nearly killing the cosmonaut Boris Volynov. Although the flight was touted as a complete success and the accident was covered up as usual, rumors spread quickly. A popular joke—an elaborate pun on the cosmonauts' last names—portrayed the four cosmonauts as "hanging about, slacking, doing zilch, barely landing."[104] The public no longer saw the difference between true accomplishment and a failure dressed up as a success.

Former public enthusiasm gave way to cynicism. Gagarin publicly admitted that "overly stormy applause led to the perception of spaceflight as a predictably easy and happy road to fame."[105] As one memoirist recalled, soon after the crash of *Soyuz 1*, in a small group of Komsomol activists Gagarin raised a toast to his fellow cosmonauts. Someone kept interrupting him, saying that space technology had already been perfected, and that it was not difficult to

become a Hero (of the Soviet Union). "Tearing up, Yuri said, 'And what about Komarov who burned up? What do you say about that?' Yuri smashed the glass on the table and turned to leave."[106]

As failures of space technology and cosmonauts' errors began to chop away at the mythological perfection of the space program, the propaganda machinery also began to sputter. The finely choreographed public welcome ceremony for the *Soyuz 4/Soyuz 5* crews was ruined by an attempted assassination of Brezhnev. At the gates to the Kremlin, a disgruntled military officer mistook the car carrying the cosmonauts Beregovoi, Nikolaev, Tereshkova, and Leonov for Brezhnev's limousine and fired fourteen shots into the car. The driver was killed, but the cosmonauts escaped unscathed.[107] The cosmonaut myth, however, received a decisive blow. Following this incident, top Soviet leaders no longer attended public welcome ceremonies for returning cosmonauts. The political status of public space events was downgraded. The cosmonauts no longer stood on the rostrum of the Lenin Mausoleum next to the country's leaders. "The cosmonaut became less visible as a symbol of political power, and more visible as a profession," writes historian Cathleen Lewis.[108]

THE STAKHANOVITES IN SPACE

The public image of Soviet cosmonauts both resembled and deviated from its most salient model—the public image of Stalin-era aviators. According to Katerina Clark, the hero pilots of the 1930s illustrated a cultural hierarchy of spiritual generations. The "sons"—the Stakhanovites and the Arctic pilots—displayed (sometimes reckless) bravery and "spontaneity." The "fathers"—flying instructors, worker mentors, and the ultimate embodiment of fatherly love, Comrade Stalin—represented "'wisdom,' 'care,' and 'sternness' to guide the chosen sons to 'consciousness.'" Clark has stressed the stability of this cultural hierarchy throughout the Stalin era: "despite the many gradations of maturity, society's sons were not to grow into fathers; rather, they were to be perfected as model sons."[109] At the dawn of the Space Age, however, Stalin's "falcons" finally acquired their own spiritual sons, the cosmonauts. The young pilots of the Gagarin generation grew up on stories of Stalinist heroes' great feats. Titov, for example, recalled how he was influenced by Soviet polar exploration tales in his childhood.[110] Kamanin noted with satisfaction someone's comment that Gagarin was setting an example for the Soviet youth, just as Kamanin did for his own generation. After Gagarin's tragic death, Kamanin, who had lost his son, an ace pilot, twenty years earlier, told Gagarin's widow: "Yuri was so dear to me, as if he were my only son."[111]

Called to be harbingers of de-Stalinization, the cosmonauts, ironically, had much in common with icons of Stalinism, their spiritual "fathers." The cosmonaut myth drew on the established canon, imagery, and ritual of Stakha-

novism, the aviator myth, and the Arctic myth of the Stalin era. The cosmonauts "received the same honors and celebratory rhetoric that aviation heroes had received a generation before."[112] Like the Stakhanovites, the cosmonauts inspired workers to boost their productivity.[113] Like Stalin's "falcons," who symbolized the union of "fearlessness with training and iron self-control,"[114] cosmonauts served as role models for their generation. Like Stalinist propaganda, the cosmonaut myth was sponsored from above, heavily promoted in the media, and reached all strata of the population, from schoolchildren to retirees. It encouraged dreams of exploration and skillfully channeled genuine public enthusiasm into actions that affirmed the Soviet technological prowess and helped legitimize the Soviet regime.

The cosmonaut myth was conceived as novel, futuristic, and high-tech, yet it was constructed out of many of the same elements as the old propaganda discourse. Paradoxically, Khrushchev's cultural policy of de-Stalinization drew on quite traditional, Stalinist rituals of hero worship and organized mass celebrations. Space propaganda was directed by a generation of ideologues brought up under Stalin, and its leading architect, Nikolai Kamanin, modeled it after his own role in the Stalinist aviation myth. The cosmonauts took their place in the generational hierarchy of Soviet spiritual heritage as "sons" of the famous aviators of the 1930s, thus becoming Stalin's spiritual "grandsons."

Unlike the Stalin-era icons, however, the cosmonauts faced a fundamental tension between their public persona and their professional identity. The Stakhanovites' mission was tied to their profession: they called on other workers to imitate their productivity drive. Stalin's hero aviators attracted masses into aviation clubs to create a large supply of pilots for the Air Force. Yet the cosmonauts' mission was not to recruit a large number of new cosmonauts. As Lewis has remarked, "there was no state sponsored inducement to adopt spaceflight as a national pastime in the name of civil defense."[115] The cosmonauts set a moral example and carried a political massage, rather than blazed a career path for the masses. The cosmonauts' professional accomplishments made them into celebrities, but in their function as celebrities they no longer needed their professional identity. To maintain their public credentials, Aleksei Stakhanov had to continue setting new records, and Valerii Chkalov had to keep flying. The cosmonauts publicly acted as propagandists, educators, and ambassadors, but not as professional pilots. They talked about peace, friendship, and science, but not about the details of their flights. Their public duties often interfered with their training for future flights. Six out of eleven first cosmonauts never flew into space again, despite their best efforts to stay on the active cosmonaut list. To function efficiently as symbols, the cosmonauts had to stop being cosmonauts.

Against their will, the cosmonauts were placed into a propaganda machine,

and they did not feel comfortable inside it. The crucial issues that interested the cosmonauts—the technological aspects of spaceflight, emergencies in orbit, and plans for future flights—were left out of their public speeches. The cosmonauts had to follow the preset agenda of the space propaganda machine, just as they had to fit into the controlling machinery of their spacecraft. Neither machine left them much room for initiative. Just as they tried to increase their control over spacecraft, the cosmonauts tried to wrestle greater control over their social role. Just as they were not perfect automatons on board, they were not ideal models in the social arena.

The medium subtly undermined the message. One might even suggest that the cosmonauts owed their popularity not to the idealized propaganda image broadcast around the world but to their human side, which was shining through despite the best efforts of their minders to hide it. Perhaps, the story of an ordinary person placed in extraordinary circumstances felt more humane and inspiring than tales of superman's super deeds.

7 REMEMBERING THE SOVIET SPACE AGE

Myth and Identity in Post-Soviet Culture

VICTOR Pelevin's novel *Omon Ra* (1991) is a gloomy parody of the official history of the Soviet space program. The main protagonist, Omon Krizomazov, inspired by Soviet propaganda, goes through grueling cosmonaut training, making many personal sacrifices along the way, only to discover that the heroic one-way lunar landing mission, for which he has been training, is merely a sham played out in front of cameras on an underground stage set. Moreover, he finds out that the entire Soviet space program is an elaborate low-tech hoax, underlying the display image of technological utopia. Pelevin's carnivalesque subversion of Soviet values goes well beyond the space program: the lunar mission stands here for the entire Soviet civilization, with its empty promises, Potemkin village technological projects, and real human sacrifice. The novel is dedicated to "the heroes of the Soviet cosmos," meaning not the actual cosmonauts but all the people stuck in the political, geographic, and cultural space of the Soviet system.[1] The novel's mockery of the hagiographic history of the Soviet space program stirred a controversy. Pelevin was reportedly denied a literary prize for "insulting the cultural memory."[2]

This chapter explores the fate of Soviet space history myths in post-Soviet culture. In today's Russia, which has lost its former communist ideals and is still searching for a unifying "national idea," Gagarin's pioneering flight—the pinnacle of the Soviet space program—often stands as a symbol of history that the Russians could really be proud of, despite the trauma of losing the

superpower status. For some, the former Soviet space triumphs stand for the lost glory of the Soviet "golden age"; for others, the former Soviet space failures epitomize the skewed priorities and dehumanizing practices of the Soviet regime; for others still, the symbols of the space era are empty signifiers flying through the post-Soviet cultural space and carrying a dazzling variety of messages—from political strategizing to consumer advertizing. The actualization of space mythology in post-Soviet discourse raises critical issues of memory and identity. Do today's Russians accept the Soviet past, with its glories and tragedies, as part of their identity? Is Soviet space history to be remembered with reverence or with shame? Or has it already lost its emotional appeal and become a historical curiosity?

THE END OF THE SOVIET UNION AND THE COLLAPSE OF THE MASTER NARRATIVE

The first visible cracks in the master narrative of Soviet space history had appeared before any winds of political change began to blow over the Soviet terrain. They came from those inside the space program who wanted to reassign credit among the major protagonists, while preserving the overall structure of the narrative. In 1974, after the failure of the Soviet human lunar program, the chief designer of rocket engines Valentin Glushko, Korolev's longtime opponent, was appointed head of Korolev's design bureau. For fifteen years, as Glushko ruled this central asset of the Soviet space program, he made a determined effort to rewrite Soviet space history by emphasizing his own contributions and downplaying Korolev's. He even ordered to remove spacecraft designed by Korolev from the bureau's internal museum and to replace them with rocket engines of his own design.[3]

The tensions that brewed under the lid of the master narrative over decades eventually came to surface as the policy of glasnost during Gorbachev's perestroika gave voice to the suppressed counter-memories. In the late 1980s, public revelations about Stalinist terror led to swift deterioration of official historical discourse. Space history was also profoundly affected. Important archival documents came to light, private diaries were published, participants began to speak out, and a totally new picture of the Soviet space program emerged, like a giant iceberg suddenly lifted out of the water. As Siddiqi has written, "the single narrative of Soviet space history—teleological and Whiggish—fractured into multiple and parallel narratives full of doubt (for the claimed successes of the program), drama (for the episodes we never knew about) and debate (over contesting narratives of history)."[4] Veteran engineers, cosmonauts, and politicians began telling stories of multiple failures during Soviet space missions, fatal errors and true heroism, favoritism in project funding, and hidden pressures to launch space missions by a politically motivated deadline.

Gorbachev's policy of glasnost opened the floodgates of social criticism that reached far beyond what he might have considered appropriate. Perestroika-era media and newly published memoirs publicly exposed lies and cover-ups in the space program, a flagship Soviet propaganda project. Some critics explicitly described the failures of the Soviet space program as emblematic of the failures of the Soviet system as a whole.

The memory of the Space Age became atomized and decentralized or, in Siddiqi's expression, "privatized" along with the Russian space industry itself. Trying to attract Western investors and clients, Russian space companies began advertising their historical achievements, opened exhibit halls for the public, and put on display rare space artifacts, including many original spacecraft. Owned and operated by space companies, these "corporate" museums produced versions of space history that placed these companies in the best possible light. A competition in today's marketplace naturally led to competing versions of history, each shored up with its own set of artifacts and corporate collections of memoirs. To this day, design bureaus and other Russian space institutions often physically hold or control access to most historical documents related to the Soviet space program, and the insiders have complete control over how, when, and to whom the documents are released.

The old mode of hero-worshipping history did not change; only now we witness clashes between followers of different space hero cults. Soviet space history was full of acrimonious disputes, including the famous fallout between Korolev and the chief rocket engine designer Valentin Glushko, or the equally famous and equally bitter rivalry between Korolev and his main domestic competitor in the space race, the chief designer of cruise missiles Vladimir Chelomei. Now a loyal team of followers gathers around each of these historical figures, and they construct their own versions of history, trying to discredit their opponents' accounts. Korolev's defenders accuse Glushko of refusing to build rocket engines for Korolev's lunar rockets and blame Chelomei for siphoning off a large part of resources of the lunar program, all this resulting in the Soviet loss of the lunar race. But the rivals have their own stories to tell. From their perspective, Korolev is often portrayed as a ruthless competitor and a clever political operator. For example, Khrushchev's son Sergei, who had worked for Chelomei, has suggested that Korolev had "focused his energy on what he did best—the elimination of his rivals."[5]

Monuments are not just silent memorials commemorating the past. Monuments do speak. On October 4, 2001, at the unveiling of Glushko's monument on Cosmonauts Alley in Moscow, a group of Russian space industry dignitaries posed in front, using the monument as a backdrop for a photo opportunity. At the same time, symbolically, they were standing guard to this monument and to a specific version of history that sanctified this particular

hero. Glushko reportedly bequeathed to inter his remains on the surface of the Moon. This bequest is cited nowadays as an inspiration for the Russians to go to the Moon.[6]

An aura of national pride is projected from the glorious past into the promising future. A heroic image of the past is enrolled to promote a specific policy agenda today. "Memorialization has become an essential function of the *current* Russian space program," Siddiqi has noted. For Russians, "truly, their future (e.g., bases on the Moon) exists in simultaneity with their past (e.g., *Sputnik*, Gagarin). It has become almost impossible to separate them."[7]

The dominant medium for reassessing the past and translating this reassessment into lessons for today and tomorrow has been a steady stream of memoirs written by veterans of the Soviet space program: cosmonauts, engineers, physicians, military officers, and administrators. By revealing hitherto unknown historic details and placing space artifacts into context, these memoirs serve as a major vehicle for exploring Soviet space history. Because archival records are largely unavailable to researchers, new revelations come mostly through such memoirs. Nowhere is the "privatization" of memory as evident as in these highly personal, often emotional and partisan, accounts. Memoirists often try to write not merely an account of their own activities within the space program but the whole history of specific periods or projects as seen from their partial perspective. In other words, they present coherent alternative versions of space history, not simply collections of bits and pieces of individual experiences. These memoirs purport to articulate "counter-memory"—an alternative to the official story line. But in fact they show a craving and nostalgia for a Soviet-style single master narrative that would elevate their own patron—be it Korolev, Glushko, or Chelomei—above others.[8] "Counter-memory" ends up reproducing the same stereotypes of the master narrative, for it still serves a propaganda purpose—if not for the central government, then for a particular group within the space industry.

The changes in the way memoirs were written from the Soviet era to perestroika to the post-Soviet period reflect an adaptation of individual memory to a specific historical context.[9] An oft-cited memoir by Oleg Ivanovskii went through multiple editions between 1970 and 2005.[10] Working under Korolev, Ivanovskii was the lead designer on the *Vostok* mission; he coordinated interaction among multiple participants in the production, testing, and launch of Gagarin's spacecraft. He later headed the space industry department of the Military-Industrial Commission of the USSR Council of Ministers, the top government body overseeing the space program. The early editions of his memoirs were published under the pseudonym Ivanov; he wrote about many leading space engineers but could not reveal their names. In the 1980s, he

added their real names but still followed the Korolev-centered master narrative. Even in the post-Soviet period, he was not ready to reveal anything about his activity inside the government bureaucracy. In the latest edition, a three-page section on this period of his life is filled entirely with quotations from other people's memoirs.[11] Without access to many original documents, the world of personal memory becomes self-referential. Ivanovskii did openly what others do implicitly or even unconsciously—he presented other people's memories as his own.

With the shortage of crucial archival sources, memoirs are becoming a major source for historical scholarship. Among the memoirs of the post-Soviet era, the most ambitious and the most influential has been the four-volume set by Korolev's deputy Boris Chertok, a sweeping and riveting account of the Soviet space program from its origins in the postwar years to the end of the Cold War. Well-informed and well-told, these memoirs, nonetheless, are written entirely from the perspective of Korolev's engineering team.[12] In Russia, the reverence for such patriarch figures and the trust in their personal accounts reach extremes. The recent fundamental, 750-page-long Russian *Encyclopedia of Human Spaceflight* often draws on memoirs. For example, the entry on the *Soyuz 15* mission consists largely in an extended quote from Chertok's memoirs.[13] In 1974, *Soyuz 15* failed to dock with the Salyut 3 space station, and an internal controversy erupted over equipment malfunctions and the actions of the crew in that incident. By letting an engineer tell his story unopposed, encyclopedia editors in effect presented a very partial view of that controversy, placing the blame on the crew.[14] When a personal perspective is so authoritatively validated and becomes a major reference source, a "counter-memory" of a previously hushed-up episode literally turns into a new master narrative.

THE NOSTALGIC POETICS OF POST-SOVIET SPACE MEMORY

In post-Soviet Russia, space myths have been put to new uses—to give comfort to those who are nostalgic of the Soviet past, to provide shared cultural references in public discourse, and to supply a handy ideological construct for those seeking a unifying "national idea." After the collapse of the Soviet Union, the mental blow of losing superpower status and the economic pain of the rapid decline of the space industry due to drastic budget cuts profoundly affected the cultural memory of the Space Age. Different groups have dealt differently with these traumas, each appropriating space myths to heal their wounds.

Space engineers have dramatically transformed their recollections of the Soviet period. The Soviet-era political leadership, often depicted as inept and shortsighted in perestroika period memoirs, suddenly acquires a better image.

Stalin, Khrushchev, and Brezhnev are now portrayed as wise leaders, who appreciated the importance of the space industry and lent it much-needed political and economic support.[15]

After the discomfitting historical revelations of the perestroika period, many Russians view Soviet space triumphs as rare moments of their history that still deserve pride. Very popular in Soviet times, the movie *Taming the Fire* has become even more culturally resonant after the collapse of the Soviet Union. Even though viewers are fully aware of the mythologization of Korolev in the movie, this myth provides a mental refuge from attacks on Soviet-era values. "Historical authenticity is not important here; the outstanding artistic qualities and technical authenticity are enough," remarks one commentator. "Watching this movie fills me with pride for the country—for the country we have lost," writes another.[16] "Every time I watch it . . . tears block my eyes and a lump rises in my throat. This is a true moment of glory for the Motherland, a breath of fresh air in the stuffy atmosphere of triumphant capitalism," confesses another viewer. "The biography of Bashkirtsev differs from Korolev's biography in many ways, but this is the way we wanted him to be and the way we saw him."[17]

The leaders of post-Soviet Russia quickly capitalized on the nostalgic value of Korolev's image. On January 12, 2007, speaking at a ceremony in the Big Kremlin Palace commemorating Korolev's centennial, President Vladimir Putin called Korolev "a scientist genius," "a true pioneer," and "the creator of the first brilliant victories of cosmonautics." Putin stressed that Korolev's efforts led to the creation of an outstanding rocket and space industry, which now assures Russia's stable position in the world and serves as a powerful resource of national development and a source of national pride.[18]

The post-Soviet movie industry generated a fresh Korolev myth. The movie *Korolev*, directed by Iurii Kara, premiered on Cosmonautics Day, April 12, 2007. The very next day the chairman of the Federation Council, the upper chamber of the Russian parliament, formally presented the film director and the lead actors with awards for a "large contribution to the propaganda of the achievements of domestic cosmonautics and to the patriotic upbringing of the youth"; after the ceremony, the movie was screened before the members of the Council.[19] The parliamentarians wanted to remind the public about the great achievements of the domestic space program with a political agenda in mind. Space industry leaders had their own motives to promote the movie. Korolev's former design bureau, now the Energiia Rocket and Space Corporation, invested twelve million rubles in the production and provided special effects.[20] The space managers hoped perhaps that, by evoking past glory and emphasizing the historic roots of today's projects, they might shore up public and government support for the space industry.

The creators of *Korolev* self-consciously set out to build a larger-than-life image of the chief designer. Kara publicly announced that "an artist has the right to have his own idea of the protagonist."[21] The movie was loosely based on the memoirs of cosmonaut Aleksei Leonov, who claimed that Korolev had confided unknown aspects of his biography to him. Evoking an earlier image of Korolev as a father figure for the cosmonauts, Leonov upped the stakes by claiming that Korolev was "more than a father for us. He was our God." The actress who played Korolev's mother echoed the sentiment, confessing that, in her opinion, "Korolev's story is akin to the story of Christ."[22]

The movie depicts Korolev as a flawless hero: a handsome, intelligent, and brave man and an exemplary husband and father. The film makes Korolev into an early space enthusiast, while historical evidence suggests that his interest in space exploration developed only after the war.[23] The script focuses on those aspects of Korolev's biography that were omitted from *Taming the Fire*, particularly on his arrest and imprisonment in the Gulag. His arrest is presented as a punishment for his passion for space exploration, while the actual reasons had to do with disputes over the design of military rockets.[24] Korolev's mythical meeting with Tsiolkovskii in Kaluga is prominently featured in the movie as a turning point in Korolev's life. Korolev emerges in the movie as a titanic figure single-handedly battling the system to implement his vision of space exploration.

The public reaction to *Korolev* proved disappointing. Critics uniformly condemned the lack of historical authenticity: "Some scenes are so obviously false and made-up that they cause laughter."[25] Mythologizing by itself, however, was not viewed as a big sin. One critic noted, for example, that the meeting with Tsiolkovskii probably did not take place, but since he was played by a very good actor, it was "worth forgoing the historical truth" for the sake of a "brilliant scene."[26] The movie's focus on Korolev's trials and tribulations, rather than triumphs, aroused public consternation. One reviewer explicitly commented how this portrayal of Korolev's biography caused discomfort, evoking painful memories: "This tragedy of one twenty-year-old romantic, this tragedy of a country destroying its best citizens—this is our terrifying history. You remember and shudder."[27] Internet forums were filled with denunciations of *Korolev* for the denigration of Soviet history. "This movie is helping not us but our enemies, who intend to defile our glorious past," read a typical review.[28] If the movie authors had a patriotic message in mind, it apparently did not get through. The audience became so distrustful of post-Soviet mythologizing that even some fact-based scenes in the movie were met with incredulity as possible inventions.

Post-Soviet audiences felt nostalgia for Soviet-era myths, which for them were comforting and inspirational. The movie *Taming the Fire* was often re-

called with fondness by critics of *Korolev*, even though they were fully aware how *Taming the Fire* mythologized Korolev's life. "*Taming the Fire*, despite its untruth, is a thousand times better [than *Korolev*], because I want to live and work after watching it," proclaimed one critic.[29]

Along with Korolev's efficient management, Yuri Gagarin's attractive smile has come to symbolize everything that was good about the Soviet past. The Russians today rank Gagarin's flight as their second proudest historical achievement (91 percent), behind the victory in World War II (93 percent), and followed by *Sputnik* (84 percent).[30] Other Soviet symbols of national pride are falling far behind: the Stalin-era creation of the atomic and hydrogen bombs, the Khrushchev-period Virgin Lands campaign, and the Brezhnev-era Baikal-Amur railroad construction are all tainted by various historic revelations that cast a dark shadow over the former showcase projects. Gagarin has been named the top "Russian idol" (35 percent), bypassing all the great Russian writers and controversial politicians.[31] "If we did not have Gagarin, we would not have been able to look into each other's eyes. It seems we blew everything we could. But we still have Gagarin. We will never lose him," writes one Russian journalist. "Gagarin is the symbol of a Russian victory over the entire world, a symbol for ages to come. We don't have another one and maybe never will. Gagarin is our national idea."[32] For many, yearning for the Gagarin myth reflects nostalgia for the Soviet system as a whole.

The Russian space program occupies such a prominent place in collective memory that any critique of its past or present is often viewed as unpatriotic. The deorbiting of the decrepit Mir space station in March 2001 caused a public outcry. The loss of Mir was portrayed in the media as a major blow to the national psyche. Radical communist opposition viewed the destruction of Mir as part of a sinister Western plot to bring down Russia and even accused President Putin of bowing to Western demands. Street protests were held, with signs reading, "Send the government to the bottom!" and "If you drown Mir, we'll drown you!"[33]

Both critics of the government and government officials appealed to the public sentiment about space history, each side trying to claim historical memory in support of its legitimacy. On April 12, 2001, on the fortieth anniversary of Gagarin's flight and just three weeks after the deorbiting of Mir, President Putin visited the Cosmonaut Training Center in Star City and gave a speech before the cosmonauts. The center personnel prepared a special backdrop for Putin's speech—a giant, full-wall-size portrait of Gagarin in full regalia—a not-so-subtle message to the president, reminding him of the appreciation of cosmonauts' achievements by previous governments. For his part, Putin also showed historical sensitivity: he assured the cosmonauts that Cosmonautics Day was celebrated not only by the cosmonauts but by the entire country.

To boost the cosmonauts' morale, which was at a historic low after the Mir demise, Putin brought them a gift. Apparently he concluded that nothing could be more valuable to the cosmonauts than reasserting the symbolic meaning of space memory, and he presented them with another portrait of Gagarin. The cosmonauts, in turn, handed the president their own gift: a watch with Gagarin's portrait on its face, and Putin immediately put it on.[34] By exchanging the gifts, the president and the cosmonauts reaffirmed their shared belief in the cosmonaut myth.[35] Both sides seemed keen to avoid confrontation over the present-day Mir controversy by reaffirming their connection with space history. This coremembrance of the celebrated past of the Soviet space program reasserted their common identity as Russian heirs to the Soviet glory.

The post-Soviet political elite have appropriated the image of Gagarin as their own ideological symbol, an emblem of national pride and technological prowess, and the inspiration for a returned superpower status. In the same way as President Putin has readopted the Imperial tricolor flag, the double-headed eagle coat of arms, and the Soviet-era national anthem with new lyrics to infuse grandeur into post-Soviet national symbols, the Soviet-era space myths are enrolled in the service of the state-sponsored project of boosting Russia's shaken prestige. In July 2008 President Dmitry Medvedev declared 2011, the fiftieth anniversary of Gagarin's flight, "the Year of Russian Cosmonautics."[36] In December 2009, Prime Minister Putin chaired a meeting of the organizing committee for Gagarin's flight anniversary celebrations. In his widely publicized speech, Putin called the *Vostok* flight "a genuine national triumph, which rallied and unified the entire nation." He called for using this opportunity to "remind the world community once again about Russia's key role in space exploration," railed against books and video games that promoted the American space achievements over the Soviet ones, and called for a comprehensive review of school textbooks to root out "falsifications" of space history.[37] A long list of state-sponsored commemorative projects included new awards and medals; the construction and renovation of museums and monuments; new books, movies, television and radio programs; conferences, youth programs, and artistic and sports events.[38] The Russian government embarked on a mission to reappropriate space myths for its own propaganda purposes, both to shore up its domestic support and to improve its image abroad. The government's proclaimed intention to fight the "falsifications" of space history echoed President Medvedev's earlier decision to set up the Presidential Commission of the Russian Federation to Counter Attempts to Falsify History to the Detriment of Russia's Interests.[39] While *detrimental* historical narratives were to be rooted out, space myths *beneficial* to the interests of the Russian state were apparently bound to thrive.

In post-Soviet culture—a jumble of old Soviet and new capitalist cultural

connotations—space myths often take the form of what the cultural critic Natalia Ivanova has termed "no(w)stalgia": neither condemnation nor idealization of the past, but its actualization as a set of appealing symbols for today's discussions. The "no(w)stalgic" audience turns into "a collective participant and a collective interpreter; a creator of a myth, a part of the myth, and a debunker of the myth; the living past and a trial of the past at the same time."[40] The cultural anthropologist Serguei Oushakine has argued that the main task of "the postsocialist poetics of nostalgic clichés" is "to produce an already known and previously encountered effect of recognition, to evoke a shared experience, to point toward a common vocabulary of symbolic gestures," and thus to overcome "a peculiar post-Soviet stylistic block, a particular expressive deficiency of postsocialism."[41]

Old symbols became frames for entirely new meanings. When President Putin and the cosmonauts needed a common language, both sides resorted to nostalgic images of the past—Gagarin's portraits—to convey their messages. The Gagarin iconography, however, was no longer tied to the specific meanings attached to it in the Soviet era. It became a shared language, which could express a wide range of new meanings. In the early 1990s, youth culture appropriated space iconography for the widely popular "Gagarin Parties," rave dance extravaganzas held at the Cosmos Pavilion in the famed Soviet Exhibit of Achievements of the National Economy in Moscow. Giant mockups of rockets and spacecraft hung from the ceiling, an enormous portrait of Gagarin was made to adorn the festivities, and real cosmonauts were invited to mingle with the crowd. Placing old Soviet memorabilia into a youth party context had a strange liberating effect: space symbols were no longer perceived as ideologically loaded emblems of Soviet propaganda or perestroika revisionism. "The juxtaposition of Soviet symbols with rave symbols, which may seem ironic and absurd," writes the cultural anthropologist Alexei Yurchak, "in fact freed the symbolic meanings attached to Gagarin and the space program from their Soviet pathos and reinvented them, making them accessible for the new cultural production."[42] Yurchak has suggested the metaphor of "sampling" to express the (re)use of Soviet symbolism in the post-Soviet culture. "As with house music—which is continuously remixed, sampled, and quoted in new contexts—here, former official symbols were also *remixed* and presented in new contexts and in a fresh, nonlinear format," he writes. "Thus, the new 'symbolic samples,' containing quotes from past and recent Soviet meanings, were placed into a dynamic new context."[43]

RUSSIAN CAPITALISM AND THE SEMIOTICS OF SPACE

In the post-Soviet era, discourses of the past and of the present interact in complex ways. As historian Martin Collins points out, the Global Age that

we live in has both changed the cultural perception of spaceflight and shifted priorities for the Space Age. The meta-narrative of exploration no longer dominates the public image of spaceflight, and new large-scale space projects tend to involve global satellite communication systems rather than ambitious human spaceflight endeavors. Instead of leading humanity away from the Earth into the enchanted unknown, space projects now connect disparate parts of the Earth, changing the very terms in which we discuss culture in general and Space Age culture in particular.[44]

Collins draws our attention to the semiotic nature of new discursive regimes: cultural symbols do not simply represent things, they act. They create a "second nature" environment in which new identities emerge and a new form of cultural power competes with and reshapes old political and institutional structures. Thus culture cannot be seen as a mere gloss on the rough surface of the crude machinery of technological innovation, economic pressures, and political decision-making. Culture is an actor in its own right—an instrument of innovation, a tool of profit making, and the stuff that politics is made of.

Both capitalism and communism manipulated symbols: capitalism made semiotics an essential part of marketing, while communism incorporated it into daily ideological indoctrination. Both generated mass production and mass consumption of symbols; any public representation sold something, be it a product or an ideological dogma. Communist propaganda officials dealt with some of the same issues as corporate marketing executives.

In post-Soviet Russia, the cultural heritage of the decades of the communist rule clashes with the newly developing capitalist culture. Russian advertising campaigns today often skillfully combine old Soviet symbolism with "new Russian" capitalist values. To what Collins has called the "mix of semiotics, capitalism, spaceflight, and the global and the local" they add the spectacularity of space symbols of the Soviet superpower, which are fashionable among the young and nurture nostalgic feelings of the old. In the summer of 2006, the cell phone provider MTS launched a billboard campaign in Moscow, promoting its new "Number One" calling plan. The billboard depicted a cosmonaut in a spacesuit happily using a cell phone in space. MTS also launched a TV commercial with the slogan "Be Number One!" This blunt attempt to brand the company as the industry leader drew on the popular Russian association of the cosmonaut image with Gagarin, the "Number One" cosmonaut. In a truly postmodern fashion, the billboard message also had a self-mocking twist: the cosmonaut was wearing space gloves, which of course made it impossible to press keys on the phone. Thus the advertisement pretended not to be an advertisement at all but, rather, an invitation to the viewer to play a semiotic game, sorting out contradictory signifiers.

The mixed feelings of pride for the glorious space achievements of the past,

FIGURE 7.1. A billboard advertisement of the "Number One" cell phone calling plan by the MTS company in the streets of Moscow, June 2006. Photo by author.

shame for losing the superpower status, and the mockery of both pride and shame as ideological constructs provided a fertile ground for the semiotic interplay of past and present, reality and simulation, truth and advertising. The ostentatious self-awareness of the simulated reality of advertising was taken to a new level in a series of MTS television ads that followed the "Number One" billboard campaign. Those ads first depicted a cosmonaut talking on a cell phone during preparations for a takeoff, but then a wider camera shot gradually revealed that the action was actually happening at a movie set being prepared for shooting a takeoff scene.[45] In a sly reference to the popular conspiracy theories about entire space missions being staged on a movie set and to the plot of *Omon Ra*, these ads again invited the viewer to blur the boundary between reality and simulation, between an advertisement and a game, and between space history and today's marketplace.

Global satellite communication and positioning systems are increasingly integrated into the Russian economy, but their political and cultural ramifications remain peculiar to Russian society and are burdened with the remembrance of the Soviet past. As late as 1999 no legal framework existed for using global positioning systems in Russia. In 1998 a batch of Volkswagen cars was

reportedly not permitted for sale in Russia, because they were equipped with GPS receivers.[46] In 2001 the Russian authorities decided to build a Russian rival to GPS, and they revitalized the stalled military project called GLONASS (GLObal NAvigation Satellite System), now broadening its use for civilian purposes. In May 2007 President Putin signed a decree authorizing free and open access to the civilian navigation signals of the GLONASS system for both Russian and foreign customers.[47] The Russian authorities promised to reach global coverage by 2010, counting that foreign consumers, especially in the Middle East and South East Asia, would be interested in having access to an alternative to the U.S.-controlled GPS.[48] Despite mammoth investments (in 2010, GLONASS consumed one-third of the annual budget of the Russian Space Agency),[49] the program suffered several setbacks due to failed launches. Only in October 2011 did the GLONASS orbital fleet reach its full capacity of twenty-four satellites, providing complete global coverage. One of the satellites went out of order in July 2014, compromising the coverage.[50]

Instead of fostering a sense of global unity, satellite navigation systems in the Russian context became a subject of international technological competition, a tool of political influence, and a vehicle for boosting national pride. U.S.-Russian negotiations on achieving technical compatibility and interoperability between GPS and GLONASS progressed slowly. In the meantime, the Russian Ministry of Industry proposed limiting the sales in Russia of GPS receivers that were not compatible with GLONASS.[51] Official policies toward global navigation systems in Russia seemed to fall back on the old Soviet stereotype of national isolationism. In March 2007 Putin held a meeting of the State Council in Kaluga, the town nicknamed "the birthplace of cosmonautics," where Tsiolkovskii spent most of his life and produced his most important works. Having reestablished historical links with Tsiolkovskii's visions of space exploration, Putin instructed the Council members that GLONASS "must work flawlessly, be less expensive, and provide better quality than GPS." He expressed his confidence that Russian consumers would show "healthy economic patriotism" and prefer GLONASS over GPS.[52] In December 2007 the first batch of dual-signal GPS/GLONASS traffic navigators was quickly sold out in Moscow stores, several months before the customers could take full advantage of GLONASS capabilities.[53]

For individual Russian users, an "eye in the sky" often evoked Soviet-era cultural memories of state surveillance. In October 2007 General Nikolai Patrushev, the head of the Federal Security Service (FSB; the successor to the KGB), announced plans for a nationwide system of traffic control. Under the banner of fighting terrorism, the FSB intended to implement a system of monitoring individual motor vehicles on the Russian territory. Technical details of the new system were not revealed, but it was implied that it might involve the

use of satellites for positioning and communication. Journalists quickly gathered initial negative reactions to the news: "it's an invasion of privacy"; "this smells like a violation of constitutional rights of citizens"; and "any surveillance brings up bad memories of Stalin's totalitarian system."[54] At the same time, individual users seemed quite willing to use GPS devices to track the movements of their own children.[55]

A shift in priorities from space exploration to satellite applications was clearly reflected in the Russian public opinion. In an April 2005 poll the highest number of respondents (52 percent) said that scientific research and the development of advanced technologies should be a top priority of the Russian space program, and 44 percent supported defense applications. Seventeen percent mentioned the importance of space achievements for international prestige, and only 1–4 percent prioritized missions to the Moon and Mars, search for extraterrestrial civilizations, and space tourism.[56] Ambitious projects of space exploration served as a token of memory, an emblem of the "no(w)stalgic" past, but they no longer dominated the cultural production of the present.

In order to remember, we have to create our memories. And we create them out of the myths and symbols of our culture. Soviet space history myths are an odd mixture of propaganda clichés and private memories of space program participants. While journalists creatively interpreted official reports and added romantic overtones to the ideological message, private stories solidified individual biases and received their share of embellishment as they passed from generation to generation. During perestroika and the early post-Soviet period, Soviet-era counter-myths of space failures were reworked into a new master narrative. Most recently, the state-sponsored propaganda of national pride again colored individual memories. Most cosmonauts became so used to wearing their assigned mask in public that it permanently attached to their faces. Tereshkova's ghost-written autobiography from the Soviet era, for example, was republished in 2003 without any changes.[57] Layers of symbolism gradually covered original memories, and remembrance and myth making seamlessly merged.

Cultural myths should not be seen merely as distorted memories. It is precisely these "distortions"—cultural adaptations and appropriations of symbols—that give different cultures their individuality, their unique character, and distinct perspective. Just as one's personal memories reveal more about one's current identity than about one's past, historical myths provide a valuable insight into the culture that produces them. At the intersection of space history and cultural history, the semiotics of Space Age remembrance

ties together individual memory and collective myth, the materiality of objects and the pliability of symbols, the authenticity of fantasy and the deceptive nature of truth.

There can be no true memory, as any act of recollection reconstitutes our memories. As the Russians remember the Space Age, it keeps changing, revealing new symbolic meanings, and providing an inexhaustible source of study for historians. By shifting the focus from debunking myths to examining their origins and their constructive role in culture, we can understand memory as a dynamic cultural force, not a static snapshot of the past.

NOTES

INTRODUCTION

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31. Golovanov, *Zametki vashego sovremennika*, 2:55.

32. See Jenks, *The Cosmonaut Who Couldn't Stop Smiling*.

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70. Iurii M. Baturin, ed., *Sovetskaia kosmicheskaia initsiativa v gosudarstvennykh dokumentakh, 1946–1964 gg.* (Moscow: RTSoft, 2008), 315–16.

71. Koroleva, *S.P. Korolev*, 3:150–73.

72. Even though the Soviet Union did not directly broadcast the *Apollo 11* lunar landing, brief news reports were shown on television. Newspaper publications were delayed, since in the first days after the lunar landing the Party Central Committee decided to centralize the *Apollo* flight coverage in the hands of the TASS news agency. See Golovanov, *Zametki vashego sovremennika*, 1:372 (diary entries for June–September 1969).

73. See Lewis, "The Red Stuff," chap. 4.

74. Lewis, "The Red Stuff," 125.

75. The photograph was taken during vacation in the southern resort of Sochi in May 1961, http://lenta.ru/photo/2011/04/11/gagarin#31.

76. V.S. Kukushin, *Istoriia arkhitektury Nizhnego Dona i Priazov'ia* (Rostov-on-Don: GinGo, 1996), http://architecture.artyx.ru/books/item/f00/s00/z0000005/st020.shtml.

77. Marina Kaminskaia, "Pochemu Gagarin—v Taganroge," *Novoe vremia*, April 8, 2011, http://www.nvgazeta.ru/news/12381/470262/.

78. Mark Wade, "Taming the Fire," *Encyclopedia Astronautica*, http://www.astronautix.com/articles/tamefire.htm.

79. Boris Chertok, *Rockets and People: The Moon Race*, vol. 4 (Washington, DC: NASA, 2011), 559–560.

80. Chertok, *Rockets and People*, 4:566–67 and 4:562. On the complicated relations between Korolev and Glushko, see Anatoliy Daron, interview by author, May–June 2008, in Slava Gerovitch, *Voices of the Soviet Space Program: Cosmonauts, Soldiers, and Engineers Who Took the USSR into Space* (New York: Palgrave Macmillan, 2014), 53–58, 64.

81. Chertok, *Rockets and People*, 4:567–68.

82. Golovanov, *Korolev*, 453.

83. Vasilii Novikov, *Khudozhestvennaiia pravda i dialektika tvorchestva* (Moscow: Sovetskii pisatel', 1974), 507.

84. Leonid Smirnov et al. to the Party Central Committee, February 2, 1966; Russian State Archive of the Economy (RGAE), Moscow, f. 4372, op. 81, d. 1944, l. 50.

85. Catherine Merridale, "War, Death, and Remembrance in Soviet Russia," in *War and Remembrance in the Twentieth Century*, ed. Jay Winter and Emmanuel Sivan (Cambridge, UK: Cambridge University Press, 1999), 77.

86. On the tension between the professional identity and the public image of Soviet cosmonauts, see chapter 6. On how secrecy shaped the identity of space engineers, see chapter 2.

87. Mikhail Tikhonravov, interview by A.P. Romanov, August 8, 1968; Russian Academy of Sciences Archive, Moscow, f. 1546, op. 1, d. 64, l. 2.

88. Boris Chertok, Notebook #16, September–November 1964, Chertok papers, Smithsonian National Air and Space Museum, Washington, DC.

89. Jenks, "The Sincere Deceiver."

90. Golovanov, *Zametki vashego sovremennika*, 1:383 (diary entries for September 1969—January 1970).

91. Golovanov, *Zametki vashego sovremennika*, 1:343 (diary entries for September–December 1968).

92. Golovanov, *Zametki vashego sovremennika*, 1:372 (diary entries for June–September 1969).

93. Kamanin, *Skrytyi kosmos*, 3: 333–34 (diary entry for December 12, 1968).

94. Kamanin, *Skrytyi kosmos*, 2:29 (diary entry for March 21, 1964); 1:176 (diary entry for October 31, 1962); 4:182 (diary entry for June 6, 1970); 4:152 (diary entry for April 18, 1970).

95. On the idealization of the Stalin era by Soviet rocket engineers, see chapter 2 in this book.

96. Irina V. Bystrova, *Voenno-promyshlennyi kompleks SSSR v gody kholodnoi*

voiny: Vtoraia polovina 40-kh–nachalo 60-kh godov (Moscow: Institut rossiiskoi istorii RAN, 2000), 244–46.

97. Semyon Ragozin, interview by author, Brighton, MA, January 6, 2009.

98. Lewis, "The Red Stuff," 312–14.

99. Quoted in Josephson, "Rockets, Reactors and Soviet Culture," 185.

100. Vladimir P. Naumov et al., comp., *Georgii Zhukov. Stenogramma oktiabr'skogo (1957) plenuma TsK KPSS i drugie dokumenty* (Moscow: Fond Demokratiia, 2001), 493.

101. Andreï Kozovoï, "Eux et nous: La guerre froide dans les histoires drôles soviétiques," *Cahiers du monde russe* 48:1 (2007): 142.

102. Boym, "Kosmos," 94.

2. STALIN'S ROCKET DESIGNERS' LEAP INTO SPACE

1. On the circumstances of Korolev's arrest, see Siddiqi, *The Red Rocket's Glare*, chap. 5.

2. Konstantin Tomilin, "Stalin sanktsioniroval ubiistvo Koroleva," *Sarov* (June 2002), http://russcience.euro.ru/papers/korolev.htm. The list with Korolev's name is kept at the Archive of the President of the Russian Federation (AP RF), Moscow, f. 3, op. 24, d. 419, l. 170, http://www.memo.ru/history/vkvs/spiski/pg11170.htm.

3. On Korolev, see Golovanov, *Korolev: Fakty i mify*; James Harford, *Korolev: How One Man Masterminded the Soviet Drive to Beat America to the Moon* (New York: John Wiley & Sons, 1997); Ishlinskii, *Akademik S. P. Korolev*; and Koroleva, *S. P. Korolev*. On Glushko, see Paver I. Kachur and Aleksandr V. Glushko, *Valentin Glushko* (St. Petersburg: Politekhnika, 2008); and Viktor F. Rakhmanin and Leonid E. Sternin, eds., *Odnazhdy i navsegda: Dokumenty i liudi o sozdatele raketnykh dvigatelei i kosmicheskikh sistem akademike Valentine Petroviche Glushko* (Moscow: Mashinostroenie, 1998).

4. Boris Raushenbakh, *Postskriptum* (Moscow: Agraf, 2001), 75.

5. Golovanov, *Korolev*, 437.

6. See, for example, introductory remarks by Iurii Koptev, then the head of the Russian Aerospace Agency, in Mozzhorin, *Tak eto bylo*, http://epizodsspace.airbase.ru/bibl/mozjorin/tak/rka.html.

7. Polly Jones, "Introduction," in *The Dilemmas of De-Stalinization*, ed. Jones, 1. Jones's volume includes an extensive bibliography on the Khrushchev period. For an excellent historiographic survey, see Miriam Dobson, "The Post-Stalin Era: De-Stalinization, Daily Life, and Dissent," *Kritika: Explorations in Russian and Eurasian History* 12:4 (2011): 905–24.

8. Boris A. Grushin, *Chetyre zhizni Rossii v zerkale oprosov obshchestvennogo mneniia*, vol. 1: *Zhizn' 1-ia. Epokha Khrushcheva* (Moscow: Progress-Traditsiia, 2001), 403.

9. Kendall Bailes, *Technology and Society under Lenin and Stalin: Origins of the Soviet Technical Intelligentsia, 1917–1941* (Princeton, NJ: Princeton University Press, 1978).

10. Walter A. McDougall, . . . *the Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985).

11. See Aldrin, "Innovation, the Scientists and the State"; Barry, "The Missile Design Bureaux"; and Siddiqi, *Challenge to Apollo*.

12. Major literature reviews in this field are Sheila Fitzpatrick, "Politics as Practice: Thoughts on a New Soviet Political History," *Kritika: Explorations in Russian and Eurasian History* 5:1 (2004): 27–54; and Barbara Walker, "(Still) Searching for a Soviet Society: Personalized Political and Economic Ties in Recent Soviet Historiography: A Review Article," *Comparative Studies in Society and History* 43:3 (July 2001): 631–42.

13. Sheila Fitzpatrick, *Everyday Stalinism. Ordinary Life in Extraordinary Times: Soviet Russia in the 1930s* (New York: Oxford University Press, 1999), 227.

14. Kiril Tomoff, "'Most Respected Comrade . . . ': Clients, Patrons, Brokers, and Unofficial Networks in the Stalinist Music World," *Contemporary European History* 11:1 (2002): 65.

15. See Gerald M. Easter, *Reconstructing the State: Personal Networks and Elite Identity in Soviet Russia* (Cambridge, UK: Cambridge University Press, 1999); and Jerry F. Hough, *The Soviet Prefects: The Local Party Organs in Industrial Decision-Making* (Cambridge, MA: Harvard University Press, 1969).

16. Walker, "(Still) Searching for a Soviet Society," 635.

17. Mark B. Adams, "Networks in Action: The Khrushchev Era, the Cold War, and the Transformation of Soviet Science," in *Science, History and Social Activism: A Tribute to Everett Mendelsohn,* ed. Garland E. Allen and Roy MacLeod (Dordrecht: Kluwer, 2001), 271.

18. For the full text of the 1946 decree, see Chertok, *Rockets and People*, 2:10–15.

19. Asif A. Siddiqi, "Series Introduction," in Chertok, *Rockets and People*, 1: xvi.

20. Koroleva, *S. P. Korolev*, 2:295.

21. Chertok, *Rockets and People*, 2:23. On the Military-Industrial Commission, see Nikolai Stroev, "Voennaia aviatsia," in *Sovetskaia voennaia moshch' ot Stalina do Gorbacheva*, ed. Aleksandr Minaev (Moscow: Voennyi parad, 1999), 279–82.

22. See Roy A. Medvedev and Zhores A. Medvedev, *Khrushchev: The Years in Power* (New York: W.W. Norton, 1978), 104–7.

23. Bystrova, *Voenno-promyshlennyi kompleks SSSR*, 250.

24. Russian State Archive of the Economy (RGAE), f. 4372, op. 79, d. 355, ll. 175–76, 216–17.

25. Georgii Pashkov, in *Akademik S. P. Korolev*, ed. Ishlinskii, 318.

26. RGAE, f. 4372, op. 81, d. 1249, ll. 139–40.

27. See Siddiqi, *Challenge to Apollo*, chaps. 9 and 11.

28. Siddiqi, *Challenge to Apollo*, 392.

29. RGAE, f. 4372, op. 81, d. 1239, ll. 25–27.

30. RGAE, f. 4372, op. 81, d. 1945, l. 16.

31. RGAE, f. 4372, op. 81, d. 1944, l. 43.

32. Vasilii Golovachev, "A Hercules Is Born," trans. Sharon Breit and Wade Holland, *Soviet Cybernetics: Recent News Items*, no. 5 (June 1967): 72.

33. Mozzhorin, *Tak eto bylo*, chap. 2, http://epizodsspace.airbase.ru/bibl/mozjorin/tak/02.html.

34. Iurii Mozzhorin, "Rol' S. P. Koroleva v razvitii otechestvennoi raketnoi i kosmicheskoi tekhniki za 50 let (1946–1966 gg.)," *Iz istorii aviatsii i kosmonavtiki*, vol. 72 (1998), http://epizodsspace.airbase.ru/bibl/iz-istorii/rol-kor.html. The Soviet government decree of May 13, 1946, stipulated, "No institutions, organizations, or individuals shall have the right to interfere with or ask for information concerning the work being conducted on reactive armaments without the special permission of the Council of Ministers"; Chertok, *Rockets and People*, 2:11.

35. Bystrova, *Voenno-promyshlennyi kompleks*, 244–46.

36. A. K. Sokolov, "Rezhimnost' na sovetskikh predpriiatiiakh," in *Rezhimnye liudi v SSSR*, ed. T. S. Kondrat'eva and A. K. Sokolov (Moscow: ROSSPEN, 2009), 99–127.

37. Miriam Dobson, *Khrushchev's Cold Summer: Gulag Returnees, Crime, and the Fate of Reform after Stalin* (Ithaca, NY: Cornell University Press, 2011).

38. Julia Fürst, *Stalin's Last Generation: Soviet Post-War Youth and the Emergence of Mature Socialism* (New York: Oxford University Press, 2010), 24.

39. Juliane Fürst, "The Arrival of Spring? Changes and Continuities in Soviet Youth Culture and Policy between Stalin and Khrushchev," in *The Dilemmas of De-Stalinization*, ed. Jones, 135–53.

40. Fürst, *Stalin's Last Generation*, 24.

41. Georgii Vetrov, comp., *S. P. Korolev i ego delo: Svet i teni v istorii kosmonavtiki* (Moscow: Nauka, 1998), 449–50.

42. *S. P. Korolev i ego delo*, comp. Vetrov, 443.

43. Chertok, *Rockets and People*, 1:5, 2:6.

44. Chertok, *Rockets and People*, 3:21.

45. Chertok, *Rockets and People*, 3:23.

46. Vasilii Mishin, "My dolzhny spustit'sia s nebes na Zemliu," *Nezavisimaia gazeta*, April 12, 2001, http://www.astronaut.ru/bookcase/article/article22.htm.

47. Konstantin Feoktistov, *Traektoriia zhizni* (Moscow: Vagrius, 2000), 36–37.

48. Vladimir Syromiatnikov, interview by author, May 25, 2004, Moscow, Russia.

49. Evgenii Shabanov [Shabarov], in *Akademik S. P. Korolev*, ed. Ishlinskii, 259.

50. Vetrov, *S. P. Korolev i ego delo*, 305–8, 319–23, 455–60.

51. Asif A. Siddiqi, "A Secret Uncovered: The Soviet Decision to Land Cosmonauts on the Moon," *Spaceflight* 46 (2004): 205–13.

52. Iurii V. Biriukov, ed., *Materialy po istorii kosmicheskogo korablia "Vostok"* (Moscow: Nauka, 2001), 213.

53. Biriukov, ed., *Materialy po istorii kosmicheskogo korablia*, 128.

54. Chertok, *Rockets and People*, 3:20.

55. Georgii Vetrov, in *Akademik S. P. Korolev*, ed. Ishlinskii, 116.

56. Boris Raushenbakh, in *Akademik S. P. Korolev*, ed. Ishlinskii, 375.

57. Feoktistov, *Traektoriia zhizni*, 223.

58. Vetrov, in *Akademik S. P. Korolev*, ed. Ishlinskii, 116.

59. Vetrov, in *Akademik S. P. Korolev*, ed. Ishlinskii, 121.

60. Georgii Vetrov, "O tvorcheskom stile Koroleva," 1975; Russian Academy of Sciences Archive, Moscow, f. 1546, op. 1, d. 50, l. 8.

61. Igor Erlikh, in *Akademik S. P. Korolev*, ed. Ishlinskii, 304.

62. Siddiqi, *Challenge to Apollo*, 501.

63. Jenks, *The Cosmonaut Who Couldn't Stop Smiling*, 95. See also Thomas Parke Hughes, *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore, MD: Johns Hopkins University Press, 1983).

64. Vasilii Mishin, who succeeded Korolev as Chief Designer after Korolev's death, lacked his former boss's talent for manipulating the system, and this spelled significant problems for Korolev's design bureau.

65. Oleg Ivanovskii, *Rakety i kosmos v SSSR: Zapiski sekretnogo konstruktora* (Moscow: Molodaia gvardiia, 2005), 51.

66. Quoted in Susanne Schattenberg, "'Democracy' or 'Despotism'? How the Secret Speech Was Translated into Everyday Life," in *The Dilemmas of De-Stalinization*, ed. Jones, 73.

67. Ivanovskii, *Rakety i kosmos*, 197–98.

68. Jones, "Introduction," 4.

69. Feoktistov, *Traektoriia zhizni*, 62.

70. For the April 1959 proposal, see Davydov, *Pervyi pilotiruemyi polet*, 1:122. Boris Chertok claims that Korolev inserted a mention of a piloted satellite in the text of the May 1959 decree; see Chertok, *Rockets and People*, 3:19. The main text of the 1959 decree, however, does not include any mention of human pilot; see Davydov, *Pervyi pilotiruemyi polet*, 1:26–129. The appendix to the decree does include provisions for the construction of life support systems; see Davydov, *Pervyi pilotiruemyi polet*, 1:150–51.

71. Valentina Ponomareva, "Osobennosti razvitiia pilotiruemoi kosmonavtiki na nachal'nom etape," in *Iz istorii raketno-kosmicheskoi nauki i tekhniki*, vyp. 3,

ed. Vsevolod S. Avduevskii et al. (Moscow: IIET RAN, 1999), 32–167; Siddiqi, *Challenge to Apollo*, 196.

72. Mikhail Kavyzin, in *Akademik S. P. Korolev*, ed. Ishlinskii, 449.

73. Felix Meschansky, interview by author, June 12, 2009, in Gerovitch, *Voices of the Soviet Space Program*, 105.

74. Boris Chertok, in *Akademik S. P. Korolev*, ed. Ishlinskii, 462.

75. Siddiqi, *Challenge to Apollo*, 198.

76. Erlikh, in *Akademik S. P. Korolev*, ed. Ishlinskii, 292.

77. On the controversy over the role of manual control, see chapter 5 in this book.

78. Valentina Ponomareva, *Zhenskoe litso kosmosa* (Moscow: Gelios, 2002), 207. See also Valentina Ponomareva, interview by author, May 17, 2002, in Gerovitch, *Voices of the Soviet Space Program*, 224.

79. Surveillance featured prominently under Khrushchev as well, when communal controls, public shaming, comrade courts, and youth street patrols were widely used to enforce state policies. Khrushchev's policy emphasized *mutual* surveillance, unlike Jeremy Bentham's Panopticon, a model prison where the invisible guards watched the prisoners. Under Khrushchev, every citizen was supposed to watch everyone else. See Oleg Kharkhordin, *The Collective and the Individual in Russia: A Study of Practices* (Berkeley: University of California Press, 1999), esp. 114, 299–300.

80. On the culture of secrecy in "closed" Soviet cities that emerged around missile and space facilities, see Siddiqi, "Cosmic Contradictions"; Siddiqi, "ZATOs in View," *Russian History Blog*, April 20, 2012, http://russianhistoryblog.org/2012/04/zatos-in-view/. On living conditions in "secret cities," see N.V. Mel'nikova, "Tvortsy sovetskogo atomnogo proekta v rezhimnykh gorodakh," in *Rezhimnye liudi v SSSR*, ed. Kondrat'eva and Sokolov, 49–66; and also studies by Xenia Vytuleva and Anna Wendland. For an insightful comparison with similar settlements in the United States, see Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (New York: Oxford University Press, 2013).

81. Chertok, in *Akademik S. P. Korolev*, ed. Ishlinskii, 461.

82. Ivanovskii, *Rakety i kosmos*, 140–41.

83. Golovanov, *Korolev*, 585–86.

84. Mark Gallai, in *Akademik S. P. Korolev*, ed. Ishlinskii, 64.

85. Vladimir I. Ivkin and Grigorii A. Sukhina, eds., *Zadacha osoboi gosudarstvennoi vazhnosti: Iz istorii sozdaniia raketno-iadernogo oruzhiia i raketnykh voisk strategicheskogo naznacheniia (1945–1959 gg.)* (Moscow: ROSSPEN, 2010), 573.

86. Ivkin and Sukhina, eds., *Zadacha osoboi gosudarstvennoi vazhnosti*, 883.

87. Chertok, *Rockets and People*, 2:27.

88. Feliks Meshchanskii, *Obratnaia storona* (Boston: n.p., 2001), 75.

89. Chertok, *Rockets and People*, 4:412–13.

90. Meshchanskii, *Obratnaia storona*, 61.

91. Chertok, *Rockets and People*, 3:29.

92. Meshchanskii, *Obratnaia storona*, 8.

93. Bystrova, *Voenno-promyshlennyi kompleks*, 214–28.

94. Chertok, *Rockets and People*, 1:8.

95. Cf. the lack of revolutionary aspirations among American engineers, who valued high professionalism and practical rationality. See Edwin Layton, *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Baltimore, MD: Johns Hopkins University Press, 1986); Ronald R. Kline, "From Progressivism to Engineering Studies: Edwin Layton's *The Revolt of the Engineers*," *Technology and Culture* 49:4 (2008): 1018–24.

96. Vladimir Syromiatnikov, *100 Stories about Docking and Other Adventures in Space: Twenty Years Back*, vol. 1 (Moscow: Universitetskaia kniga, 2005), 463.

97. Bailes, *Technology and Society*, 3.

98. Stroev, "Voennaia aviatsia," 280.

3. "NEW SOVIET MAN" INSIDE MACHINE

1. Raleigh, *Russia's Sputnik Generation*, 133.

2. Grushin, *Chetyre zhizni Rossii*, 1:403.

3. Chertok, *Rockets and People*, 3:61.

4. Georgii Beregovoi, as quoted in Valentina Ponomareva, "Nachalo vtorogo etapa razvitiia pilotiruemoi kosmonavtiki (1965–1970 gg.)," in *Issledovaniia po istorii i teorii razvitiia aviatsionnoi i raketno-kosmicheskoi tekhniki*, vyp. 8–10, ed. Boris Raushenbakh (Moscow: Nauka, 2001), 166.

5. Ponomareva, *Zhenskoe litso kosmosa*, 207.

6. Ponomareva, "Nachalo vtorogo etapa," 170.

7. Mikhail Heller, *Cogs in the Soviet Wheel: The Formation of Soviet Man*, trans. David Floyd (London: Collins Harvill, 1988).

8. Vladimir Papernyi, *Architecture in the Age of Stalin: Culture Two*, trans. John Hill and Roann Barris (New York: Cambridge University Press, 2002).

9. See Igal Halfin, *From Darkness to Light: Class, Consciousness, and Salvation in Revolutionary Russia* (Pittsburgh, PA: University of Pittsburgh Press, 2000); Igal Halfin, *Terror in My Soul: Communist Autobiographies on Trial* (Cambridge, MA: Harvard University Press, 2003); and Jochen Hellbeck, *Revolution on My Mind: Writing a Diary under Stalin* (Cambridge, MA: Harvard University Press, 2006).

10. Sheila Fitzpatrick, *Tear Off the Masks! Identity and Imposture in Twentieth-Century Russia* (Princeton, NJ: Princeton University Press, 2005).

11. Elena Zubkova, *Russia after the War: Hopes, Illusions, and Disappointments, 1945–1957*, trans. Hugh Ragsdale (Armonk, NY: M.E. Sharpe, 1998), chap. 17.

12. Kharkhordin, *The Collective and the Individual*, esp. 299–300.

13. Bailes, *Technology and Society under Lenin and Stalin*, 391.

14. Bergman, "Valerii Chkalov," 139.

15. Bailes, *Technology and Society under Lenin and Stalin*, 386.

16. Paul R. Josephson, "'Projects of the Century' in Soviet History: Large-Scale Technologies from Lenin to Gorbachev," *Technology and Culture* 36:3 (July 1995): 519–59. See also Palmer, *Dictatorship of the Air*, chap. 8.

17. Bailes, *Technology and Society under Lenin and Stalin*, 381.

18. Bailes, *Technology and Society under Lenin and Stalin*, 387.

19. Golovanov, *Korolev*, 198; "Prichinoi gibeli posluzhilo stremlenie postavit' mirovoi sverkhrekord," *Istochnik*, no. 2 (1997): 89–108, http://epizodsspace.no-ip.org/bibl/istochnik/1997/os1.html. On the "race to the stratosphere," see Smith, *Rockets and Revolution*, chap. 9.

20. Bailes, *Technology and Society under Lenin and Stalin*, 390; Bergman, "Valerii Chkalov," 151.

21. Iosif Stalin, "Vystuplenie na prieme v Kremle v chest' uchastnikov Parada Pobedy" (1945), in *Sochineniia*, vol. 15 (Moscow: Pisatel', 1997), 232.

22. Michael O'Mahony, *Sport in the USSR: Physical Culture—Visual Culture* (London: Reaktion Books, 2006), 113.

23. Quoted in Andrew Jenks, "A Metro on the Mount: The Underground as a Church of Soviet Civilization," *Technology and Culture* 41:4 (October 2000): 697.

24. Bergman, "Valerii Chkalov," 143, 149.

25. Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge: MIT Press, 2002), chap. 1.

26. Iosif Stalin, "O zadachakh khoziaistvennikov" (1931), in *Sochineniia*, vol. 13 (Moscow: Politizdat, 1951), 41. Stalin made a priority the education of the young Soviet technical intelligentsia who would replace the treacherous "bourgeois specialists." He said, "Bolsheviks must master technology. It is time for Bolsheviks themselves to become specialists. In the reconstruction period, technology decides everything. And the industrial administrator who does not want to study technology, who does not want to master technology, is a joke and not an administrator"; quoted in Sheila Fitzpatrick, *The Cultural Front: Power and Culture in Revolutionary Russia* (Ithaca, NY: Cornell University Press, 1992), 154. See also Mark R. Beissinger, *Scientific Management, Socialist Discipline, and Soviet Power* (Cambridge, MA: Harvard University Press, 1988), 124.

27. Iosif Stalin, "Rech' v Kremlevskom dvortse na vypuske akademikov Krasnoi armii" (1935), in *Sochineniia*, vol. 14 (Moscow: Pisatel', 1997), 61. In this speech, Stalin wanted to show that he sided with "little people," the masses, in their disputes with local leadership, and that he hoped they would help overcome

the industrial leaders' reluctance to raise production output. See Fitzpatrick, *The Cultural Front*, 169; J. Arch Getty, *Origins of the Great Purges: The Soviet Communist Party Reconsidered, 1933–1938* (Cambridge, UK: Cambridge University Press, 1987), 104; David L. Hoffmann, *Stalinist Values: The Cultural Norms of Soviet Modernity, 1917–1941* (Ithaca, NY: Cornell University Press, 2003), 70.

28. It might be tempting to interpret this tension in terms of debate over technological determinism. Indeed, the Marxist dialectic of the forces of production and the relations of production leaves room both for reductionist models of technology driving history and for more subtle interpretations of social relations shaping the development of technology. The contradictions of Stalinist discourse, however, are more likely to be rooted in conflicting agendas of different social groups than in fundamental theoretical dilemmas of Marxism.

29. Bergman, "Valerii Chkalov," 138.

30. Boris Chertok, notebook #41, March 29, 1961; National Air and Space Museum, Smithsonian Institution, Washington, DC, Chertok papers.

31. Golovanov, *Nash Gagarin*, 50–51.

32. Quoted in Siddiqi, *Challenge to Apollo*, 244.

33. Nikolai Kamanin, *Skrytyi kosmos*, 3:335 (diary entry for December 12, 1968).

34. Kamanin, *Skrytyi kosmos*, 1:23 (diary entry for March 2, 1961), 43 (diary entry for April 4, 1961).

35. As it turned out, two people independently told Gagarin the combination before the launch so that he would not waste his time in case of real emergency. See Chertok, *Rockets and People*, 3:62.

36. Siddiqi, *Challenge to Apollo*, 264.

37. Kamanin, *Skrytyi kosmos*, 1:23 (diary entry for March 2, 1961).

38. Kamanin, *Skrytyi kosmos*, 1:149–50 (diary entry for August 16, 1962).

39. Siddiqi, *Challenge to Apollo*, 244.

40. On Soviet cybernetics, see Slava Gerovitch, *From Newspeak to Cyberspeak*.

41. Evgenii I. Boiko et al., "Kibernetika i problemy psikhologii," in *Kibernetiku—na sluzhbu kommunizmu*, ed. Aksel' I. Berg, vol. 5 (Moscow: Energiia, 1967), 316.

42. Vladimir I. Iazdovskii, *Na tropakh Vselennoi* (Moscow: Slovo, 1996), chap. 1.

43. Georgii T. Beregovoi et al., *Eksperimental'no-psikhologicheskie issledovaniia v aviatsii i kosmonavtike* (Moscow: Nauka, 1978), 64–67.

44. Records of the Psychology Section of the Council on Cybernetics, 1962; Russian Academy of Sciences Archive, Moscow, f. 1807, op. 1, d. 24, ll. 27–29.

45. Viktor G. Denisov, "Nekotorye aspekty problemy sochetaniia cheloveka i mashiny v slozhnykh sistemakh upravleniia," in *Problemy kosmicheskoi biologii*, ed. Norair M. Sisakian and Vladimir I. Iazdovskii, vol. 2 (Moscow: Nauka, 1962), 54.

46. Viktor G. Denisov et al., "Osnovnye problemy inzhenernoi psikhologii kosmicheskogo poleta," in *Problemy kosmicheskoi biologii*, ed. Norair M. Sisakian and Vladimir I. Iazdovskii, vol. 3 (Moscow: Nauka, 1964), 77.

47. Denisov, "Nekotorye aspekty," 55.

48. Aleksandr I. Men'shov, *Kosmicheskaia ergonomika* (Leningrad: Nauka, 1971), 14.

49. Petr K. Isakov et al., "Problemy nadezhnosti cheloveka v sistemakh upravleniia kosmicheskim korablem," in *Problemy kosmicheskoi biologii*, ed. Norair M. Sisakian, vol. 7 (Moscow: Nauka, 1967), 6.

50. Valerii N. Kubasov et al., *Professional'naia podgotovka kosmonavtov* (Moscow: Mashinostroenie, 1985), 6; Men'shov, *Kosmicheskaia ergonomika*, 11.

51. Kubasov et al., *Professional'naia podgotovka*, 6.

52. Men'shov, *Kosmicheskaia ergonomika*, 10.

53. Denisov et al., "Osnovnye problemy," 67; Men'shov, *Kosmicheskaia ergonomika*, 220.

54. Denisov et al., "Osnovnye problemy," 66–67; Isakov et al., "Problemy nadezhnosti cheloveka," 5; Men'shov, *Kosmicheskaia ergonomika*, 237.

55. Quoted in Vladimir Komarov, 1961, workbook no. 39, Gagarin Memorial Museum Archive, Gagarin, Smolensk region, Russia; http://authors.library.caltech.edu/5456/1/hrst.mit.edu/hrs/apollo/soviet/documents/doc-komarov39.pdf.

56. Kubasov et al., *Professional'naia podgotovka*, 190.

57. Ponomareva, *Zhenskoe litso kosmosa*, 207.

58. Igor' A. Poletaev, *Signal: O nekotorykh poniatiiakh kibernetiki* (Moscow: Sovetskoe radio, 1958), 281.

59. Iurii Gagarin, *Doroga v kosmos* (Moscow: Pravda, 1961), 137.

60. Quoted in A.N. Babiichuk, *Chelovek, nebo, kosmos* (Moscow: Voenizdat, 1979), 209.

61. Kubasov et al., *Professional'naia podgotovka*, 138.

62. Kubasov et al., *Professional'naia podgotovka*, 235.

63. Valentin V. Lebedev, *Moe izmerenie* (Moscow: Nauka, 1994), 246–247 (diary entry for September 3, 1982).

64. Fedor D. Gorbov and Fedor P. Kosmolinskii, "Ot psikhologii aviatsionnoi do psikhologii kosmicheskoi," *Voprosy psikhologii*, no. 6 (1967): 49.

65. Chertok, *Rockets and People*, 3:225.

66. Ponomareva, "Nachalo vtorogo etapa," 170. For specific examples of how the Soviet approach to automation of control affected the course of various space missions, see chapter 5.

67. Gorbov and Kosmolinskii, "Ot psikhologii aviatsionnoi do psikhologii kosmicheskoi," 50.

68. Georgii T. Beregovoi et al., "Ob otsenke effektivnosti raboty cheloveka v usloviiakh kosmicheskogo poleta." *Voprosy psikhologii*, no. 4 (1974): 7.

69. V.A. Dovzhenko et al., "Spetsial'naia parashiutnaia podgotovka kosmonavtov," in *Materialy XXXVII chtenii K. E. Tsiolkovskogo*, Kaluga, 2002; http://readings.gmik.ru/lecture/2002-spetsialnaya-parashyutnaya-podgotovka-kosmonavtov.

70. Rostislav B. Bogdashevskii et al., "Psikhologicheskaia podgotovka i bezo-pasnost' kosmicheskogo poleta," in *Materialy XXXVII chtenii K. E. Tsiolkovskogo*, Kaluga, 2003; http://readings.gmik.ru/lecture/2003-psihologicheskaya-podgotovka-i-bezopasnost-kosmicheskogo-poleta.

771. Gorbov and Kosmolinskii, "Ot psikhologii aviatsionnoi do psikhologii kosmicheskoi," 50.

72. Isakov et al., "Problemy nadezhnosti cheloveka," 10.

73. Golovanov, *Nash Gagarin*, 137.

74. Valerii N. Kubasov, *Prikosnovenie kosmosa* (Moscow: Politizdat, 1984), 125.

75. Dovzhenko et al., "Spetsial'naia parashiutnaia podgotovka."

76. Irina Solov'eva, interview by author, June 9, 2004, Zvezdnyi gorodok (Star City), Moscow Region, Russia.

77. Lebedev, *Moe izmerenie*, 281 (diary entry for September 19, 1982).

78. Lebedev, *Moe izmerenie*, 272 (diary entry for September 15, 1982).

79. Ada Ordyanskaya, interview by author, August 28, 2008, and October 11, 2011, in Gerovitch, *Voices of the Soviet Space Program*, 240.

80. Georgii T. Beregovoi and Andrei I. Iakovlev, *Modelirovanie system poluavtomaticheskogo upravleniia kosmicheskikh korablei* (Moscow: Mashinostroenie, 1986), 59.

81. Gorbov and Kosmolinskii, "Ot psikhologii aviatsionnoi do psikhologii kosmicheskoi," 49.

82. Igor' B. Ushakov et al., eds., *Istoriia otechestvennoi kosmicheskoi meditsiny* (Voronezh: Voronezhskii gosudarstvennyi universitet, 2001), chap. 16.

83. Gorbov and Kosmolinskii, "Ot psikhologii aviatsionnoi do psikhologii kosmicheskoi," 51.

84. Siddiqi, *Challenge to Apollo*, 416.

85. Ponomareva, "Nachalo vtorogo etapa," 170.

86. See Jenks, *The Cosmonaut Who Couldn't Stop Smiling*, 103–19.

87. Kubasov et al., *Professional'naia podgotovka*, 190.

88. Syromiatnikov, *100 Stories about Docking*, 163.

89. Kubasov et al., *Professional'naia podgotovka*, 190.

90. David R. Scott and Alexei A. Leonov, *Two Sides of the Moon: Our Story of the Cold War Space Race* (London: Simon & Schuster, 2004), 109.

91. N.N. Gurovskii et al., "Trenazhery dlia podgotovki kosmonavtov k professional'noi deiatel'nosti po upravleniiu korablem i ego sistemami," in *Problemy kosmicheskoi biologii*, ed. N.M. Sisakian, vol. 4 (Moscow: Nauka, 1965), 6; Siddiqi, *Challenge to Apollo*, 451.

92. Boris Chertok [B. Evseev], "Chelovek ili avtomat?" in *Shagi k zvezdam*, ed. Vasilii Mishin [M. Vasil'ev] (Moscow: Molodaia gvardiia, 1972), 286.

93. Chertok [Evseev], "Chelovek ili avtomat?" 284–85; Kubasov, *Prikosnovenie kosmosa*, 123; Lebedev, *Moe izmerenie*, 258 (diary entry for September 8,1982).

94. Chertok [Evseev], "Chelovek ili avtomat?" 284–86.

95. Lebedev, *Moe izmerenie*, 258 (diary entry for September 8,1982).

96. Kubasov, *Prikosnovenie kosmosa*, 123.

97. Ponomareva, *Zhenskoe litso kosmosa*, 285.

98. Valentina Ponomareva, interview by author, May 17, 2002, in Gerovitch, *Voices of the Soviet Space Program*, 220.

99. Ponomareva, interview by author, in Gerovitch, *Voices of the Soviet Space Program*, 221.

100. Sonja Schmid, *Producing Power: The Pre-Chernobyl History of the Soviet Nuclear Industry* (Cambridge: MIT Press, 2015).

101. Chertok, *Rockets and People*, 4:289.

102. *Materialy XXII s"ezda* (Moscow: Gospolitizdat, 1962), 411.

103. Jones, "Introduction," in *The Dilemmas of De*-Stalinization, ed. Jones, 9.

104. See Smith, *Rockets and Revolution*, chap. 4; Richard Stites, *Revolutionary Dreams: Utopian Vision and Experimental Life in the Russian Revolution* (New York: Oxford University Press, 1989), chap. 7.

105. Launius, "Heroes in a Vacuum," 1, 10.

106. Trevor S. Rockwell, "They May Remake Our Image of Mankind: Representations of Cosmonauts and Astronauts in Soviet and American Propaganda Magazines, 1961–1981," in *Spacefarers*, ed. Neufeld, 139.

107. Sergei Okhapkin, quoted in Chertok, *Rockets and People*, 3:258.

108. David Mindell, "Human and Machine in the History of Spaceflight," in *Critical Issues in the History of Spaceflight*, 153, 158. See also David A. Mindell, *Digital Apollo: Human and Machine in Spaceflight* (Cambridge: MIT Press, 2008), chap. 9.

109. See Manfred E. Clynes and Nathan S. Kline, "Cyborgs and Space [1960]," in *The Cyborg Handbook*, ed. Chris Hables Gray (London: Routledge, 1995), 29–33; N. Sisakian, "Biologiia i osvoenie kosmosa," *Aviatsiia i kosmonavtika*, no. 2 (1962): 24–30.

110. Kamanin, *Skrytyi kosmos*, 3:348 (diary entry for December 28, 1968).

4. THE HUMAN IN THE ARMS OF TECHNOLOGY

Epigraph: Oleg Ivanovskii [Aleksei Ivanov], *Vpervye: Zapiski vedushchego konstruktora* (Moscow: Moskovskii rabochii, 1982), 224.

1. See chapter 1 in this book.

2. For some technical detail and institutional context of Gagarin's mission,

incorporating material available by 2000, see Siddiqi, *Challenge to Apollo*, chaps. 5 and 7. A recent biography of Gagarin, based on archival research, provides broader political and propaganda context of his flight; see Jenks, *The Cosmonaut Who Couldn't Stop Smiling*. Other important historical works include Golovanov, *Korolev*, and Rex Hall and David J. Shayler, *The Rocket Men: Vostok & Voskhod, The First Soviet Manned Spaceflights* (Chichester, UK: Springer/Praxis, 2001). These works, however, could not take advantage of two recently published vast collections of archival documents on Gagarin's flight: Davydov, ed., *Pervyi pilotiruemyi polet*; and Larisa V. Uspenskaia, comp., *Chelovek. Korabl'. Kosmos: Sbornik dokumentov k 50-letiiu poleta v kosmos Iu. A. Gagarina* (Moscow: Novyi khronograf, 2011). The author also had an opportunity to examine the archival audio recordings of communications during Gagarin's flight at the Russian State Archive of Scientific and Technical Documentation (RGANTD) in Moscow.

3. Chertok, *Rockets and People*, 3:67. See also Kamanin, *Skrytyi kosmos*, 1:46–47 (diary entry for April 8, 1961).

4. Vladimir V. Molodtsov, "Istoriia proektirovaniia korablia 'Vostok,'" *Kosmicheskii al'manakh*, no. 5 (2001), http://epizodsspace.no-ip.org/bibl/akiem/5v-vostok.html.

5. Kamanin, *Skrytyi kosmos*, 3:335 (diary entry for December 12, 1968).

6. Chertok, *Rockets and* People, 3:61.

7. Ponomareva, "Osobennosti razvitiia pilotiruemoi kosmonavtiki"; Siddiqi, *Challenge to Apollo*, 196; Uspenskaia, *Chelovek. Korabl'. Kosmos*, 213.

8. Davydov, *Pervyi pilotiruemyi polet*, 1:363.

9. Kamanin, *Skrytyi kosmos*, 1:22–23 (diary entry for March 2, 1961). Vladimir Iazdovskii was the chief physician; Mark Gallai, a piloting instructor; Semen Alekseev, the chief designer of parachutes; Mstislav Keldysh, vice president of the Soviet Academy of Sciences; Konstantin Bushuev and Leonid Voskresenskii, Korolev's deputies; and Leonid Smirnov, a government official, one of the leaders of the defense industry.

10. "Po gorizontu raduzhnaia oranzhevaia polosa, potom golubo-chernaia . . . ," *Otechestvennye arkhivy*, no. 2 (2006), http://www.rusarchives.ru/publication/raushenbah.shtml.

11. Kamanin, *Skrytyi kosmos*, 1:30 (diary entry for March 18, 1961).

12. Kamanin, *Skrytyi kosmos*, 1:38 (diary entry for March 29, 1961).

13. Boris Chertok, notebook #41, March 29, 1961; National Air and Space Museum, Smithsonian Institution, Washington, DC, Chertok papers.

14. In January 1934 the pilot Pavel Fedoseenko, the engineer Andrei Vasenko, and the physicist Il'ia Usyskin reached the altitude of twenty-two kilometers (14 miles), dedicating their feat to the Seventeenth Party Congress. They died in a crash landing. Golovanov, *Korolev*, 198; "Prichinoi gibeli posluzhilo strem-

lenie postavit' mirovoi sverkhrekord," *Istochnik*, no 2 (1997): 89–108, http://epizodsspace.no-ip.org/bibl/istochnik/1997/os1.html.

15. Quoted in Sergei Leskov, "Gibel' vozdushnogo 'Titanika,'" *Izvestia*, January 29, 2004, http://izvestia.ru/news/286366.

16. Davydov, *Pervyi pilotiruemyi polet*, 1:371.

17. Oleg Ivanovskii, in *Bessmertie Gagarina*, ed. Iurii Ustinov (Moscow: Geroi otechestva, 2004), 111. See also Davydov, *Pervyi pilotiruemyi polet*, 1:360.

18. German Formin, "Pochemu polety 'Vostokov' i 'Voskhodov' byli bezavarinymi," *Novosti kosmonavtiki*, no. 6 (2004): 60–61; no. 7 (2004): 60–61.

19. Kamanin, *Skrytyi kosmos*, 1:29–30 (diary entry for March 18, 1961).

20. Kamanin, *Skrytyi kosmos*, 1:43 (diary entry for April 4, 1961).

21. Nikita S. Khrushchev, *Vremia. Liudi. Vlast,'* vol. 4 (Moscow: Moskovskie novosti, 1999), 215.

22. Davydov, *Pervyi pilotiruemyi polet*, 1:380. Valerii Kalmykov was the minister of radioelectronics; Petr Dement'ev, the minister of aviation industry; Boris Butoma, the minister of ship-building industry; Kirill Moskalenko, the commander of the Strategic Missile Forces; Konstantin Vershinin, the commander of the Air Force; and Petr Ivashutin, deputy head of the KGB.

23. Davydov, ed., *Pervyi pilotiruemyi polet*, 1:372–73, 381–82; see also Kamanin, *Skrytyi kosmos*, 1:39 (diary entry for March 29, 1960). According to Mozzhorin, there was also another, shortest, version of the announcement, which reported the death of a cosmonaut at the liftoff or while reaching the orbit; Iurii Mozzhorin, in *Nachalo kosmicheskoi ery*, vyp. 2, ed. Mozzhorin (Moscow: RGANTD, 1994), 276.

24. Mark Gallai, *S chelovekom na bortu* (Moscow: Sovetskii pisatel', 1985), 104–5.

25. Kamanin, *Skrytyi kosmos*, 1:45 (diary entry for 5 April 1961).

26. Kamanin, *Skrytyi kosmos*, 1:44 (diary entry for 5 April 1961).

27. Kamanin, *Skrytyi kosmos*, 1:46 (diary entry for 6 April 1961) and 1:47 (diary entry for 8 April 1961).

28. Gallai, *S chelovekom na bortu*, 100–101.

29. Quoted in Anton Pervushin, *108 minut, izmenivshie mir* (Moscow: Eksmo, 2011), 306–7. Valerii Chkalov was a famous Stalin-era aviator.

30. Golovanov, *Korolev*, 641.

31. Nikolai Kamanin, "Kosmicheskie dnevniki," *Novosti kosmonavtiki*, no. 15 (1994) (diary entry for April 11, 1961), http://88.210.62.157/content/numbers/078/29.shtml. This fragment was omitted in the book edition of Kamanin's memoirs.

32. Uspenskaia, *Chelovek. Korabl'. Kosmos*, 545.

33. Ada Kotovskaia, interview by Pavel Sharov, *Novosti kosmonavtiki*, no. 4 (2007), http://novosti-kosmonavtiki.ru/mag/2007/677/22942/.

34. Kamanin, *Skrytyi kosmos*, 1:52 (diary entry for April 12, 1961).

35. Ivanovskii [Ivanov], *Vpervye*, 264. See also Gallai, *S chelovekom na bortu*, 126.

36. Kamanin, *Skrytyi kosmos*, 1:51 (diary entry for April 11, 1961).

37. Davydov, *Pervyi pilotiruemyi polet*, 1:440. Service words confirming communication are omitted. There are several versions of the transcript of Gagarin's mission. A public version of the transcript appeared in Nikolai Kamanin, *Letchiki i kosmonavty* (Moscow: Politizdat, 1971), 354–68, reprinted in *Materialy po istorii kosmicheskogo korablia "Vostok,"* ed. Biriukov, 147–58. A secret version, submitted to the Party Central Committee, was declassified and published (with time stamps) in 1991; see "Zvezdnyi reis Iuriia Gagarina," *Izvestiia TsK KPSS*, no. 5 (1991): 101–29; it was reprinted in Davydov, *Pervyi pilotiruemyi polet*, 1:438–53. In 2001 a complete transcript of the archival audio (without time stamps) was published in *Kommersant Vlast',* no. 14 (April 10, 2001), http://kommersant.ru/doc/253447, and *Kommersant Vlast',* no. 15 (April 17, 2001), http://kommersant.ru/doc/253987. There are numerous discrepancies between the public version, the secret version, and the archival audio, which was apparently edited from the original recording. This chapter quotes from the version published in *Pervyi pilotiruemyi polet* (with time stamps, for ease of reference), with corrections from *Kommersant Vlast',* the archival audio, and other sources.

38. Davydov, *Pervyi pilotiruemyi polet*, 1:445.

39. Quoted in Tamara Kutuzova, "Sto vosem' minut istorii," *Tekhnika—molodezhi*, no. 4 (1978), http://epizodsspace.no-ip.org/bibl/tm/1978/4/108m.html.

40. Iurii S. Karpov and Vladimir Ia. Khil'chenko, "O polete korablia-sputnika 'Vostok' i doklade Iu. A. Gagarina," 1997 Gagarin Conference proceeedings, town of Gagarin, Smolensk region, Russia, http://www.spek.keytown.com:81/sites/default/files/rasIIIProg/5_tvorch/Space40/1997/books_97/Karpov.htm.

41. Davydov, *Pervyi pilotiruemyi polet*, 1:445.

42. Davydov, *Pervyi pilotiruemyi polet*, 1:451.

43. Iazdovskii, *Na tropakh Vselennoi*, chap. 1.5, http://www.astronaut.ru/bookcase/books/yazdovski/text/07.htm.

44. Gurii P. Stupakov et al., "Sozdanie sistemy meditsinskogo obespecheniia pervogo poleta cheloveka v kosmos i ee znachenie v razvitii kosmicheskoi meditsiny kak nauki," in 1996 Gagarin Conference proceeedings, http://www.spek.keytown.com:81/sites/default/files/rasIIIProg/5_tvorch/Space40/1996/books_96/Stupakov.htm.

45. Davydov, *Pervyi pilotiruemyi polet*, 1:446.

46. A. Hamidulin and Ol'ga Chernysheva, "'Byli trudnosti i u Gagarina': Fonozapisi vospominanii sovremennikov," *Istoricheskii arkhiv*, no. 4 (1999): 54.

47. Gallai, *S chelovekom na bortu*, 18.

48. Mark Gallai, *Cherez nevidimye bar'ery. Ispytano v nebe* (Moscow: Molodaia gvardiia, 1969).

49. Viktor Svergun and V. Ageev, "Put' k 'Vostoku,'" *Aviatsiia i kosmonavtika*, nos. 3–4 (1994): 42–43, http://www.epizodsspace.narod.ru/bibl/stati/put-k-vost.html.

50. Feoktistov, *Traektoriia zhizni*, 133; Nikolai Mudryi, interview by Sergei Andreev, *Smena*, June 19, 2007, http://www.smena.ru/news/2007/06/19/11240.

51. Valentina L. Ponomareva, "Problema obespecheniia bezopasnosti kosmonavta na uchastke vyvedeniia: Istoricheskii aspect," in 1996 Gagarin Conference proceeedings, http://www.spek.keytown.com:81/sites/default/files/rasIIIProg/5_tvorch/Space40/1996/books_96/Ponomar.htm.

52. Davydov, *Pervyi pilotiruemyi polet*, 1:307–8. According to Kamanin, the State Commission for Launch trusted him and Korolev with the ejection decision; see Kamanin, *Skrytyi kosmos*, 1:47 (diary entry for April 8, 1961). According to Korolev's biographer Iaroslav Golovanov, three people knew the password for issuing the ejection command: Korolev; the chief launch officer, Anatolii Kirillov; and Korolev's deputy in charge of testing, Leonid Voskresenskii; see Golovanov, *Korolev*, 646.

53. Davydov, *Pervyi pilotiruemyi polet*, 1:446. The transcript is corrected according to the archival audio recording; see Onboard audio recording, Vostok mission, April 12, 1961; RGANTD, audio track 408-1.

54. Davydov, *Pervyi pilotiruemyi polet*, 1:307–8.

55. Davydov, *Pervyi pilotiruemyi polet*, 1:447. The transcript is corrected according to the archival audio recording. The excerpt published in Golovanov, *Korolev*, 651, matches the archival audio.

56. Davydov, *Pervyi pilotiruemyi polet*, 1:308.

57. Davydov, *Pervyi pilotiruemyi polet*, 1:364.

58. Davydov, *Pervyi pilotiruemyi polet*, 1:447. The words "Kosberg has fired!" are missing from the published transcript and from the (apparently edited) archival audio recording and are reconstructed from witness accounts.

59. Kutuzova, "Sto vosem' minut istorii"; Ernest Vaskevich, "Polet v vechnost'," *Znamia*, no. 4 (1984): 217.

60. The secret version submitted to the Party authorities also omitted an exchange between Gagarin and Korolev, in which Korolev described delicious sausage awaiting Gagarin on his return, and Gagarin joked that it would go down well with a drink. Everybody laughed, while Korolev remarked that the tape recorder was on. Gagarin immediately started reporting about onboard equipment tests. See "Podgotovka izdeliia idet normal'no," *Kommersant Vlast',* no. 15, April 17, 2001, http://kommersant.ru/doc/253987. The editor of the transcript apparently found the mention of alcohol in the context of a heroic deed inappropriate.

61. Davydov, *Pervyi pilotiruemyi polet*, 1:447.

62. Kamanin, *Skrytyi kosmos*, 1:33 (diary entry for March 21, 1961).

63. Kamanin, *Skrytyi kosmos*, 1:52 (diary entry for April 12, 1961).

64. Dmitrii Iu. Gol'dovskii and German A. Nazarov, *Pervye polety v kosmos*

(Moscow: Znanie, 1986), http://www.astronaut.ru/bookcase/books/goldovsky/text/06.htm.

65. Stupakov et al., "Sozdanie sistemy."

66. Davydov, *Pervyi pilotiruemyi polet*, 1:452–53.

67. Davydov, *Pervyi pilotiruemyi polet*, 1:363. See also Chertok, *Rockets and People*, 3:62.

68. Vladimir D. Iastrebov, in *Nachalo kosmicheskoi ery*, vyp. 2, ed. Mozzhorin, 319–20.

69. Chertok, *Rockets and People*, 3:291.

70. Chertok, *Rockets and People*, 3:73.

71. Davydov, *Pervyi pilotiruemyi polet*, 1:448.

72. Davydov, *Pervyi pilotiruemyi polet*, 1:449.

73. "The First Man in Space," NASA/JPL translation of Soviet Radio and Newspaper Reports, May 1, 1961. The version of the TASS announcement published in *Pravda* on April 13, 1961, listed the perigee of 175 kilometers (110 miles) and the apogee of 302 kilometers (188 miles).

74. Sviatoslav Lavrov, "On skazal: 'Poekhali!'" *PC Week (Russian edition)*, no. 12, April 11, 2000, http://www.pcweek.ru/themes/detail.php?ID=53991.

75. Davydov, *Pervyi pilotiruemyi polet*, 2:42–46.

76. Quoted in Siddiqi, *Challenge to Apollo*, 279, with corrections. For the Russian original, see Davydov, *Pervyi pilotiruemyi polet*, 1:481. The emphasized phrase is added, based on the archival audio recording.

77. Davydov, ed., *Pervyi pilotiruemyi polet*, 2:44.

78. Davydov, ed., *Pervyi pilotiruemyi polet*, 2:44.

79. German Formin, "Pravda o vozvrashchenii Iuriia Gagarina," *Novosti kosmonavtiki*, no. 4 (2002): 3–4.

80. Davydov, *Pervyi pilotiruemyi polet*, 1:363.

81. Biriukov, *Materialy po istorii kosmicheskogo korablia "Vostok,"* 82.

82. Quoted in Siddiqi, *Challenge to Apollo*, 279, with corrections. "VN" stands for *Vse normal'no*. For the Russian original, see Davydov, *Pervyi pilotiruemyi polet*, 1:481.

83. A technical report on *Vostok* clearly stated that the thermal sensors were part of the emergency separation system; see Davydov, *Pervyi pilotiruemyi polet*, 1:364.

84. Davydov, *Pervyi pilotiruemyi polet*, 2:42.

85. Formin, "Pravda o vozvrashchenii Iuriia Gagarina," 4.

86. Iurii Karpov, "ChP pri spuske ne bylo," *Krasnaia Zvezda*, April 12, 2001, http://old.redstar.ru/2001/04/12_04/hist23.html.

87. Karpov and Khil'chenko, "O polete korablia-sputnika."

88. Iurii P. Semenov, ed., *Raketno-kosmicheskaia korporatsiia "Energiia" imeni S. P. Koroleva, 1946–1996* (Korolev: RKK "Energiia," 1996), 110.

89. Svergun and Ageev, "Put' k 'Vostoku.'"

90. Feoktistov, *Traektoriia zhizni*, 102.

91. Pavel Barashev and Vasilii Peskov, "Piat' chasov s Iuriem Gagarinym," *Komsomol'skaia pravda*, April 15, 1961, 4.

92. Davydov, *Pervyi pilotiruemyi polet*, 1:483.

93. Kamanin, *Skrytyi kosmos*, 1:84 (diary entry for December 28, 1961).

94. Davydov, *Pervyi pilotiruemyi polet*, 2:45.

95. Iazdovskii, *Na tropakh Vselennoi*, chap. 1.5.

96. Georgii Fomin and Oksana Efimenko, "Iz Samary—v kosmos," *Samara segodnia*, April 12, 2011, http://samaratoday.ru/news/16255.

97. Kamanin, *Skrytyi kosmos*, 1:52–53 (diary entry for April 12, 1961).

98. Igor' Lisov and Igor' Afanas'ev, "106 minut Gagarina v svete rassekrechennykh dokumentov," *Novosti kosmonavtiki*, no. 6 (2011): 4, 8.

99. David Novoplianskii, "Prizemlenie," *Komsomol'skaia pravda*, April 14, 1961, 1.

100. David Novoplianskii, "Pervye minuty," *Komsomol'skaia pravda*, April 15, 1961, 4.

101. Kamanin, *Skrytyi kosmos*, 1:47 (diary entry for April 8, 1961).

102. Iastrebov, in *Nachalo kosmicheskoi ery*, vyp. 2, 32021.

103. "Records File on the First Space Flight by the USSR Citizen Yuri Alexeyevich Gagarin," April 12, 1961, http://www.fai.org/downloads/icare/records_file_gagarin. For the Russian original, see "Delo o rekordakh pervogo kosmicheskogo poleta grazhdanina SSSR Iu. A. Gagarina," April 12, 1961; RGANTD, f. 24, op. 1, d. 1, l. 5, http://www.cosmoworld.ru/spaceencyclopedia/gagarin/index.shtml?delo.html.

104. FAI record files ## 9326, 9327, 9328, http://www.fai.org/fai-record-file/?recordId=9326; http://www.fai.org/fai-record-file/?recordId=9327; http://www.fai.org/fai-record-file/?recordId=9328.

105. Barashev and Peskov, "Piat' chasov s Iuriem Gagarinym."

106. "The Dawn of a New Era," *Izvestia,* April 16, 1961, translated in *The First Man in Space: Soviet Radio and Newspaper Reports on the Flight of the Spaceship Vostok-I*, compiled and translated by Joseph L. Zygielbaum (Pasadena, CA: JPL Caltech, 1961).

107. The first admission was made in Evgenii Riabchikov, *Russians in Space*, translated by Guy Daniels (Moscow: Novosti, 1971), 36; see Siddiqi, *Challenge to Apollo*, 283. By that time, the FAI had amended its rules "to recognize that the great technological accomplishment of spaceflight was the launch, orbiting and safe return of the human, not the manner in which he or she landed"; Cathleen S. Lewis, "Why Yuri Gagarin Remains the First Man in Space, Even Though He Did Not Land inside His Spacecraft," April 12, 2010, http://blog.nasm.si.edu/2010/04/12/why-yuri-gagarin-remains-the-first-man-in-space-even-though-he-did-not-land-inside-his-spacecraft/.

108. V.S. Gubarev, "Viza Mozzhorina," in *Tak eto bylo: Memuary Iu. A. Mozzhorina. Mozzhorin v vospominaniiakh sovremennikov*, ed. N.A. Anfimov (Moscow: Mezhdunarodnaia programma obrazovaniia, 2000), http://epizodsspace.no-ip.org/bibl/mozjorin/tak/vosp.html; Iurii Mozzhorin, "50 let v raketno-kosmicheskoi otrasli," in *Tak eto bylo*, ed. Anfimov, chap. 3, http://epizodsspace.no-ip.org/bibl/mozjorin/tak/03.html.

109. Quoted in Siddiqi, *Challenge to Apollo*, 278, with additions and corrections. For the Russian original, see Davydov, *Pervyi pilotiruemyi polet*, 1:479.

110. Davydov, *Pervyi pilotiruemyi polet*, 1:490–91.

111. Iurii Gagarin, Report to the State Commission, April 13, 1961; RGANTD, audio track 408-4. The official transcript was classified at the time and submitted to the Party Central Committee; see Davydov, *Pervyi pilotiruemyi polet*, 1:476–85.

112. Sergei G. Darevskii, "Kosmonavtika i aviatsiia: Ikh vzaimodeistvie pri podgotovke pervykh kosmonavtov," in 1996 Gagarin Conference proceeedings, http://www.spek.keytown.com:81/sites/default/files/rasIIIProg/5_tvorch/Space40/1996/books_96/Darevsk.htm.

113. Mozzhorin, in *Nachalo kosmicheskoi ery*, vyp. 2, ed. Mozzhorin, 276.

114. For Kamanin's version, see Kamanin, *Letchiki i kosmonavty*, 354–68. For the version submitted to the Soviet leaders, see Davydov, *Pervyi pilotiruemyi polet*, 1:438–53.

115. "Russia Displays *Vostok* with Spherical Cabin," *Aviation Week* (May 17, 1965): 28–29.

5. HUMAN-MACHINE ISSUES, THE COSMONAUT PROFESSION, AND COMPETING VISIONS OF SPACEFLIGHT

1. Kamanin, *Skrytyi kosmos*, 3:335 (diary entry for December 12, 1968).

2. Georgii Beregovoi, as quoted in Valentina Ponomareva, "Nachalo vtorogo etapa," 166.

3. Chertok, *Rockets and People*, 3:576.

4. Wiebe E. Bijker, Thomas Hughes, and Trevor J. Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge: MIT Press, 1987); Nelly Oudshoorn and Trevor Pinch, eds., *How Users Matter: The Co-construction of Users and Technology* (Cambridge: MIT Press, 2003).

5. See Stephen J. Garber, "Birds of a Feather? How Politics and Culture Affected the Designs of the US Space Shuttle and the Soviet Buran," MA thesis, Virginia Institute of Technology, 2002; Leon Trilling, "Styles of Military Technical Development: Soviet and US Jet Fighters, 1945–1960," in *Science, Technology, and the Military*, ed. Everett Mendelsohn, Merritt Roe Smith, and Peter Weingart (Dordrecht, Netherlands: Kluwer, 1988), 155–85.

6. Ponomareva, "Osobennosti razvitiia pilotiruemoi kosmonavtiki"; Siddiqi, *Challenge to Apollo*, 196; Uspenskaia, *Chelovek. Korabl'. Kosmos*, 213.

7. Loyd S. Swenson Jr., James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, DC: NASA, 1989); Robert B. Voas, "A Description of the Astronaut's Task in Project Mercury," *Human Factors* (July 1961): 149–65.

8. For a comparison of the technical parameters of manual control panels on American and Soviet spacecraft, see Beregovoi et al., *Eksperimental'no-psikhologicheskie issledovaniia*, 62–63.

9. Mindell, *Digital Apollo*, 165.

10. Golovanov, *Korolev*, 604. A similar argument is presented in Ponomareva, "Osobennosti razvitiia," 144.

11. Chertok, *Rockets and People*, 3:257.

12. Ponomareva, "Osobennosti razvitiia," 161.

13. See Vetrov, *S.P. Korolev i kosmonavtika*.

14. Vasilii P. Mishin, *Dnevniki: Zapisi i vospominaniia*, vol. 1 (Voronezh: Kvarta, 2014), 137.

15. Ponomareva, "Osobennosti razvitiia," 147.

16. Ponomareva, *Zhenskoe litso kosmosa*, 113. See also Valentina Ponomareva, interview by author, May 17, 2002, in Gerovitch, *Voices of the Soviet Space Program*, 226.

17. See Yuriy Tyapchenko, interview by author, May 2002, in Gerovitch, *Voices of the Soviet Space Program*, 119–20.

18. Ponomareva, "Osobennosti razvitiia," 145.

19. Kamanin, *Skrytyi kosmos*, 1:23 (diary entry for March 2, 1961).

20. See chapter 4 in this book.

21. Davydov, *Pervyi pilotiruemyi polet*, 1:111, 1:122, 1:126–29, and 1:150–51.

22. Quoted in Aleksei Eliseev, *Zhizn'—kaplia v more* (Moscow: Aviatsiia i kosmonavtika, 1998), 15.

23. Sergei Korolev, "Tezisy doklada po kosmosu," June 1960; Russian State Archive of the Economy (RGAE), Moscow, f. 298, op. 1, d. 1483, l. 246.

24. Kamanin, *Skrytyi kosmos*, 1:174 (diary entry for September 13, 1962).

25. Kamanin, *Skrytyi kosmos*, 1:149 (diary entry for August 16, 1962).

26. Eliseev, *Zhizn'—kaplia v more*, 46–47.

27. Siddiqi, *Challenge to Apollo*, 457.

28. Babiichuk, *Chelovek, nebo, kosmos*, 239.

29. Eliseev, *Zhizn'—kaplia v more*, 58.

30. *Voskhod 2* flight communications, audio recording, March 19, 1965; Russian State Archive of Scientific and Technical Documentation (RGANTD), Moscow, f. 1, ed. khr. 278-7.

31. Golovanov, *Zametki vashego sovremennika*, 1:240.

32. Pavel Beliaev, Report to the State Commission, March 22, 1965, audio recording; RGANTD, f. 1, ed. khr. 138-1.

33. Aleksei Leonov, Report to the State Commission, March 22, 1965, audio recording; RGANTD, f. 1, ed. khr. 138-2.

34. Beliaev, Report to the State Commission.

35. Chertok, *Rockets and People*, 3:268; Eliseev, *Zhizn'—kaplia v more*, 58; Kamanin, *Skrytyi kosmos*, 2:190 (diary entry for April 22, 1965); Ponomareva, "Osobennosti razvitiia," 157–58; Siddiqi, *Challenge to Apollo*, 458; Scott and Leonov, *Two Sides of the Moon*, 116–18.

36. Kamanin, *Skrytyi kosmos*, 2:197 (diary entry for May 8, 1965), 2:199 (diary entry for May 13, 1965).

37. Syromiatnikov, *100 Stories about Docking*, 97.

38. See Beregovoi et al., *Eksperimental'no-psikhologicheskie issledovaniia*, 192, 270; Ponomareva, "Nachalo vtorogo etapa"; Ponomareva, "Osobennosti razvitiia."

39. Vasilii Mishin, quoted in Kamanin, *Skrytyi kosmos*, 2:368 (diary entry for August 17, 1966).

40. Siddiqi, *Challenge to Apollo*, 246.

41. Gherman S. Titov, "30 let spustia," *Aviatsiia i kosmonavtika*, no. 8 (1991): 26.

42. Kamanin, *Skrytyi kosmos*, 1:394 (diary entry for December 7, 1963); 2:333 (diary entry for April 25, 1966); 3:159 (diary entry for January 15, 1968).

43. Kamanin, *Skrytyi kosmos*, 3:44 (diary entry for March 22, 1967).

44. Chertok, *Rockets and People*, 4:167.

45. Quoted in Kamanin, *Skrytyi kosmos*, 2:368 (diary entry for August 17, 1966).

46. Siddiqi, *Challenge to Apollo*, 566.

47. Chertok, *Rockets and People*, 3:232.

48. Eliseev, *Zhizn'—kaplia v more*, 165.

49. Eliseev, *Zhizn'—kaplia v more*, 91.

50. See chapter 3 in this book.

51. Kubasov et al., *Professional'naia podgotovka kosmonavtov*, 278.

52. Beregovoi et al., *Eksperimental'no-psikhologicheskie issledovaniia*, 31.

53. Vladimir Shatalov, interview by author and Asif Siddiqi, May 28, 2006, in Gerovitch, *Voices of the Soviet Space Program*, 152.

54. Chertok, *Rockets and People*, 3:641.

55. Chertok, *Rockets and People*, 4:481.

56. Kamanin, *Skrytyi kosmos*, 3:303 (diary entry for October 29, 1968). For details of the *Soyuz 2/Soyuz 3* mission, see Siddiqi, *Challenge to Apollo*, 657–62.

57. Kamanin, *Skrytyi kosmos*, 4:11 (diary entry for January 10, 1969), 4:12 (diary entry for January 11, 1969).

58. Vladimir A. Shatalov, *Trudnye dorogi kosmosa*, 2nd ed. (Moscow: Molodaia gvardiia, 1981), 129.

59. Kubasov et al., *Professional'naia podgotovka*, 138.

60. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 152.

61. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 173. For details of the *Soyuz 4/Soyuz 5* mission, see Siddiqi, *Challenge to Apollo*, 668–74.

62. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 154.

63. Chertok, *Rockets and People*, 4:249–50; Rex Hall and David J. Shayler, *Soyuz: A Universal Spacecraft* (Chichester, UK: Springer/Praxis, 2003), 159.

64. For details of the *Soyuz 6/Soyuz 7/Soyuz 8* mission, see Siddiqi, *Challenge to Apollo*, 705–11.

65. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 154–55.

66. Kamanin, *Skrytyi kosmos*, 4:95 (diary entry for October 15, 1969).

67. Ponomareva, "Nachalo vtorogo etapa," 169.

68. Chertok, *Rockets and People*, 4:484.

69. Chertok [B. Evseev], "Chelovek ili avtomat?" 282.

70. Siddiqi, *Challenge to Apollo*, 534–38.

71. Chertok, *Rockets and People*, 4:156.

72. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 153–54.

73. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 163.

74. "Cosmonauts Unfairly Blamed for Failure of Soyuz 15 Flight," JPRS-USP-94-007 (October 5, 1994), 4–5, translation of Mikhail Rebrov, "Gorkii privkus slavy," *Krasnaia zvezda* (September 9, 1994): 2.

75. Asif A. Siddizi, "The Almaz Space Station Complex: A History, 1964–1992: Part I," *Journal of the British Interplanetary Society* 54 (2001): 411–14.

76. Hall and Shayler, *Soyuz*, 186–87; Ponomareva, "Nachalo vtorogo etapa," 169–70.

77. Chertok, *Rockets and People*, 4:497–98.

78. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 164. See also Vladimir A. Shatalov, *Kosmicheskie budni* (Moscow: Mashinostroenie, 2008), 162–65.

79. Chertok, *Rockets and People*, 4:498.

80. Eliseev, *Zhizn'—kaplia v more*, 200–204.

81. Chertok, *Rockets and People*, 4:502.

82. Iurii M. Baturin, ed., *Mirovaia pilotiruemaia kosmonavtika. Istoriia. Tekhnika. Liudi* (Moscow: RTSoft, 2005), 273–74.

83. Eliseev, *Zhizn'—kaplia v more*, 209.

84. Scott and Leonov, *Two Sides of the Moon*, 189.

85. Siddiqi, *Challenge to Apollo*, 504–5.

86. Scott and Leonov, *Two Sides of the Moon*, 190.

87. Vitalii V. Chesnokov, "Argon-11C computer," http://www.computer-museum.ru/english/argon11c.htm; Georgiy Priss, interview by author, May 23, 2002, in Gerovitch, *Voices of the Soviet Space Program*, 84; Viktor Przhiyalkovskiy, interview by author, May 24, 2002, in Gerovitch, *Voices of the Soviet Space Program*, 128–30.

88. Iurii A. Tiapchenko, "Sistemy otobrazheniia informatsii pilotiruemykh KA L1 i N1-L3," http://www.cosmoworld.ru/spaceencyclopedia/publications/index.shtml?tg_moon.html.

89. Aleksei Leonov, interview by Igor Marinin and Dmitrii Vostrikov, *Novosti kosmonavtiki*, no. 10 (2002): 66–72; Pavel Popovich, interview by Vladimir Shunevich, *Fakty* (Kiev), July 18, 2003, http://www.epizodsspace.narod.ru/bibl/intervy/popovich.html.

90. Scott and Leonov, *Two Sides of the Moon*, 252.

91. Siddiqi, *Challenge to Apollo*, 699–700.

92. Siddiqi, *Challenge to Apollo*, 495–97.

93. Chertok, *Rockets and People*, 4:96, 4:121.

94. Siddiqi, *Challenge to Apollo*, 491.

95. Mindell, *Digital Apollo*, 240; Mary Cummings et al., "Conceptual Human-System Interface Design for a Lunar Access Vehicle," MIT Humans and Automation Laboratory Report HAL2005-04, September 2005, 118–19, http://web.mit.edu/aeroastro/labs/halab/papers/HSI_interim_report_1.pdf. Soviet engineers believed that American astronauts had two minutes at their disposal for a landing decision. See also Chertok, *Rockets and People*, 4:261.

96. Chertok, *Rockets and People*, 4:257, 4:264.

97. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 167.

98. Kamanin, *Skrytyi kosmos*, 3:123 (diary entry for October 15, 1967), 3:147 (diary entries for December 2–3, 1967), 3:341 (diary entry for December 23, 1968); Siddiqi, *Challenge to Apollo*, 650.

99. Kamanin, *Skrytyi kosmos*, 3:123–124 (diary entry for October 15, 1967).

100. Kamanin, *Skrytyi kosmos*, 3:312 (diary entry for November 13, 1968).

101. Scott and Leonov, *Two Sides of the Moon*, 189.

102. Eliseev, *Zhizn'—kaplia v more*, 63, 65.

103. Kamanin, *Skrytyi kosmos*, 4:74 (diary entry for September 3, 1969).

104. Shatalov, interview, in Gerovitch, *Voices of the Soviet Space Program*, 166–67.

105. Siddiqi, *Challenge to Apollo*, 734–36.

106. Quoted in Kamanin, *Skrytyi kosmos*, 1:57 (diary entry for May 25, 1961). Later on, Gagarin seemed to have changed his opinion and supported the first civilian engineers who joined the cosmonaut corps; see Georgii Grechko, "Iz-za liubvi k kino ia chut' ne prozeval polet v kosmos!" *Vechernii Omsk*, no. 11, February 11, 2004, http://www.epizodsspace.narod.ru/bibl/intervy/grechko3.html.

107. Kamanin, *Skrytyi kosmos*, 1:105 (diary entry for April 19, 1962).

108. Scott and Leonov, *Two Sides of the Moon*, 146.

109. Kamanin, *Skrytyi kosmos*, 1:210 (diary entry for January 17, 1963).

110. Chertok, *Rockets and People*, 3:232.

111. Kamanin, *Skrytyi kosmos*, 3:210 (diary entry for April 8, 1968).

112. Iazdovskii, *Na tropakh Vselennoi*, chap. 1.

113. On the first women's cosmonaut group, see Aleksandr Glushko, "40 let pervoy zhenskoi gruppe kosmonavtov," *Novosti kosmonavtiki*, no. 5 (2002): 69–71; Ponomareva, *Zhenskoe litso kosmosa*; and Irina Solov'eva, "35 let poletu 'Vostok-6,'" *Novosti kosmonavtiki*, nos. 12–14 (1998).

114. Chertok, *Rockets and People*, 3:225.

115. Chertok, *Rockets and People*, 3:227.

116. Eliseev, *Zhizn'—kaplia v more*, 28, 164.

117. Mishin, *Dnevniki*, 2:64–65.

118. Kamanin, *Skrytyi kosmos*, 2:134 (diary entry for February 2, 1965).

119. Georgii Grechko, *Start v neizvestnost'* (Moscow: Pravda, 1989), chap. 2.

120. Valentin Lebedev, interview by Denis Komar'kov, *Osnova* (Naro-Fominsk), no. 26, May 28, 2004, http://www.epizodsspace.narod.ru/bibl/intervy/lebedev1.html.

121. Vasilii Mishin, "I Contend That There Is No Cosmonaut Profession," *Nezavisimaia gazeta*, April 13, 1993, 6 (JPRS-USP-93-002, May 18, 1993, 28).

122. Viktor D. Pekelis, *Cybernetic Medley*, trans. Oleg Sapunov (Moscow: Mir, 1986), 287.

123. Chertok, *Rockets and People*, 3:232.

124. Konstantin Feoktistov, interview by Sergei Kuznetsov, *Voronezhskie vesti*, no. 27 (July 2, 2003), http://www.epizodsspace.narod.ru/bibl/intervy/feoktistov3.html.

125. Eliseev, *Zhizn'—kaplia v more*, 172–73. On the fate of the group of cosmonaut trainees from the Soviet Academy of Sciences, none of whom got a chance to fly to space, see Ordinard Kolomiytsev, interview by author, July–August 2010, in Gerovitch, *Voices of the Soviet Space Program*, chap. 11.

126. Lebedev, interview.

127. Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012).

6. THE HUMAN INSIDE A PROPAGANDA MACHINE

1. Baturin, *Sovetskaia kosmicheskaia initsiativa*, 123–25.

2. Ponomareva, *Zhenskoe litso kosmosa*, 122.

3. Scott W. Palmer, *Dictatorship of the Air: Aviation Culture and the Fate of Modern Russia* (Cambridge, UK: Cambridge University Press, 2006), chap. 7.

4. Ponomareva, *Zhenskoe litso kosmosa*, 122.

5. Baturin, *Sovetskaia kosmicheskaia initsiativa*, 165–66.

6. Golovanov, *Nash Gagarin*, 190.

7. See James T. Andrews, "In Search of a Red Cosmos: Space Exploration, Public Culture, and Soviet Society," in *Societal Impact of Spaceflight*, ed. Stephen J. Dick and Roger D. Launius, NASA SP-2007-4801 (Washington, DC: NASA, 2007), 41–52; Andrews and Siddiqi, *Into the Cosmos*; Michael Froggatt, "Science in Propaganda and Popular Culture in the USSR under Khruschev (1953–1964)," PhD diss., University of Oxford, 2006; Josephson, "Rockets, Reactors and Soviet Culture"; Jenks, *The Cosmonaut Who Couldn't Stop Smiling*; Maurer et al., *Soviet Space Culture*; and Trevor S. Rockwell, "The Molding of the Rising Generation: Soviet Propaganda and the Hero-Myth of Iurii Gagarin," *Past Imperfect* 12 (2006), http://ejournals.library.ualberta.ca/index.php/pi/article/view/1579/1105.

8. Lewis, "The Red Stuff," 99–100.

9. See chapter 5 in this book.

10. Propaganda in the Soviet Union was directed by the Agitation and Propaganda Department of the Party Central Committee, or Agitprop (later the Ideological Department). Similar departments and positions were established at Party committees at all levels, from Soviet republics to regions to cities and down to individual enterprises. These departments issued ideological work guidelines and implemented them in the media and through various public events, such as mass rallies, lectures, and seminars. After the denunciation of Stalin's "personality cult" the propaganda apparatus was undergoing a reform aimed at eliminating dogmatism and falsehoods, "brightening up" propaganda discourse, and expanding into new media, such as television. For an overview of Soviet space propaganda efforts, see Trevor S. Rockwell, "Space Propaganda 'For All Mankind': Soviet and American Responses to the Cold War, 1957–1977," PhD diss., University of Alberta, 2012.

11. Mikhail B. Chernenko et al., eds., *V kosmose Nikolaev i Popovich* (Moscow: Pravda, 1963), 92.

12. Iurii Baturin, ed., *Sovetskie i rossiiskie kosmonavty: 1960–2000* (Moscow: Novosti kosmonavtiki, 2001); Siddiqi, *Challenge to Apollo*, 246.

13. Ustinov, *Bessmertie Gagarina*, 291.

14. German [Gherman] Titov, *Golubaia moia planeta* (Moscow: Voenizdat, 1977), 207–8.

15. Kamanin, *Skrytyi kosmos*, 1:54 (diary entry for April 13, 1961).

16. On the symbolic continuity between Stalin-era aviators and Khrushchev-era cosmonauts, see chapter 3 in this book.

17. Golovanov, *Korolev*, 665.

18. See Baturin, *Sovetskaia kosmicheskaia initsiativa*, 201–2; Kamanin, *Skrytyi kosmos*, 1:101–2 (diary entry for April 12, 1962); Aleksandr M. Pesliak, "Den' kosmonavtiki: Istoricheskie fakty i sovremennyi analiz," *Novosti kosmonavtiki*, no. 6 (2005): 24–25.

19. *Programme of the Communist Party*, 17.

20. Baturin, *Sovetskaia kosmicheskaia initsiativa*, 202–3.

21. Kamanin, *Skrytyi kosmos*, 1:55 (diary entry for April 21, 1961).

22. Kamanin, *Skrytyi kosmos*, 2:58 (diary entry for June 25, 1964).

23. Kohonen, "The Heroic and the Ordinary."

24. Kamanin, *Skrytyi kosmos*, 1:199 (diary entry for December 27, 1962); 2:71 (diary entry for August 17, 1964); 1:221 (diary entry for February 8, 1963); 1:329 (diary entry for July 30, 1963); 2:125 (diary entry for January 13, 1965).

25. Viktor Mitroshenkov, *Zemlia pod nebom: Khronika zhizni Iuriia Gagarina*, 2nd ed. (Moscow: Sovetskaia Rossiia, 1987), 317.

26. Kamanin, *Skrytyi kosmos*, 2:332 (diary entry for April 25, 1966).

27. Kamanin, *Skrytyi kosmos*, 1:108 (diary entry for April 25, 1962); 2:217 (diary entry for September 6, 1965); 1:346 (diary entry for September 27, 1963); 2:232–33 (diary entry for October 1, 1965).

28. Kamanin, *Skrytyi kosmos*, 1:71–72 (diary entry for December 2, 1961); 1:210 (diary entry for January 17, 1963); 2:239 (diary entry for October 14, 1965); 1:313 (diary entry for July 11, 1963).

29. "Akt o rezul'tatakh ekzamenov," 18 January 1961; Gagarin Memorial Museum Archive, Town of Gagarin, Smolensk Region, Russia.

30. Golovanov, *Nash Gagarin*, 56.

31. Kamanin, *Skrytyi kosmos*, 2:233 (diary entry for October 2, 1965).

32. Victoria Smolkin-Rothrock, "Cosmic Enlightenment: Scientific Atheism and the Soviet Conquest of Space," in *Into the Cosmos*, ed. Andrews and Siddiqi, 185.

33. Kamanin, *Skrytyi kosmos*, 2:269 (diary entry for December 4, 1965); 1:219 (diary entry for February 5, 1963); 1:376 (diary entry for November 10, 1963); 1:369 (diary entry for October 7, 1963); 1:369 (diary entry for October 29, 1963); 1:376 (diary entry for November 10, 1963).

34. Kamanin, *Skrytyi kosmos*, 1:391 (diary entry for November 28, 1963).

35. Roshanna Sylvester, "She Orbits over the Sex Barrier: Soviet Girls and the Tereshkova Moment," in *Into the Cosmos*, ed. Andrews and Siddiqi, 195–212.

36. Kamanin, *Skrytyi kosmos*, 1:374 (diary entry for November 3, 1963).

37. In 1962 Gagarin and Titov were elected deputies of the USSR Supreme Soviet; a year later, Nikolaev and Popovich were elected members of the Supreme Soviets of Russia and Ukraine, respectively; and in 1966 Tereshkova became a deputy of the USSR Supreme Soviet (after 1974, a member of its Presidium).

38. Kamanin, *Skrytyi kosmos*, 2:61 (diary entry for July 2, 1964) and 4:188 (diary entry for June 14, 1970).

39. Kamanin, *Skrytyi kosmos*, 1:281 (diary entry for June 7, 1963) and 2:29 (diary entry for March 21, 1964).

40. Kamanin, *Skrytyi kosmos*, 1:225 (diary entry for February 16, 1963); 1:236 (diary entry for March 13, 1963); 1:226 (diary entry for February 16, 1963).

41. Golovanov, *Nash Gagarin*, 31.

42. Khodzha Akhmad Abbas [Khwaja Ahmad Abbas], "Rasskaz o Iurii Gagarine," *Aviatsiia i kosmonavtika*, no. 4 (1962): 78–85.

43. Golovanov, *Nash Gagarin*, 281.

44. Vladimir Rossoshanskii, *Fenomen Gagarina* (Saratov: Letopis', 2004), 20.

45. Abbas, "Rasskaz o Iurii Gagarine."

46. Jenks, *The Cosmonaut Who Couldn't Stop Smiling*, 152, 174, 175.

47. Baturin, *Sovetskaia kosmicheskaia initsiativa*, 148–49, 190–91, 227–28, 261–63, 277–78.

48. Richard Stites, *Russian Popular Culture: Entertainment and Society since 1900* (Cambridge, UK: Cambridge University Press, 1992), 145–46.

49. Ponomareva, *Zhenskoe litso kosmosa*, 122.

50. Loren R. Graham, *Moscow Stories* (Bloomington: Indiana University Press, 2006), 18–19.

51. Feoktistov, *Traektoriia zhizni*, 188. See also Ponomareva, *Zhenskoe litso kosmosa*, 242.

52. Kamanin, *Skrytyi kosmos*, 1:164 (diary entry for August 28, 1962) and 2:57 (diary entry for June 25, 1964).

53. Kamanin, *Skrytyi kosmos*, 1:123 (diary entry for June 27, 1962); 2:57 (diary entry for June 25, 1964); 2:90 (diary entry for September 24, 1964).

54. Kamanin, *Skrytyi kosmos*, 2:10 (diary entry for January 21, 1964); 1:224 (diary entry for February 15, 1963); 2:198 (diary entry for May 10, 1965); 2:187 (diary entry for April 20, 1965); 1:170 (diary entry for September 5, 1962); 4:252 (diary entry for January 23, 1971).

55. Eduard Buinovskii, *Priobshchenie k kosmosu: Zapiski nesletavshego kosmonavta*, chap. 6, http://samlib.ru/b/bujnowskij_e_i/priobshenie.shtml. The description of this episode is somewhat muffled in the book edition of Buinovskii's memoirs; see Eduard Buinovskii, *Povsednevnaia zhizn' pervykh rossiiskikh raketchikov i kosmonavtov* (Moscow: Molodaia gvardiia, 2005), 159.

56. Golovanov, *Nash Gagarin*, 183.

57. Abbas, "Rasskaz o Iurii Gagarine."

58. Golovanov, *Zametki vashego sovremennika*, 1:278.

59. Kamanin, *Skrytyi kosmos*, 1:57 (diary entry for May–September 1961).

60. Davydov, *Pervyi pilotiruemyi polet*, 1:513.

61. Kamanin, *Skrytyi kosmos*, 1:73 (diary entry for December 4, 1961).

62. Francis French, "Yuri Gagarin's Visit to Manchester," *Spaceflight* 40:7 (July 1998): 261–63.

63. Kamanin, *Skrytyi kosmos*, 2:187 (diary entry for April 20, 1965); 1:332 (diary entry for August 2, 1963); 1:197–98 (diary entry for December 22, 1962).

64. Kamanin, *Skrytyi kosmos*, 1:76 (diary entry for December 7, 1961).

65. Golovanov, *Nash Gagarin*, 207.

66. Golovanov, *Nash Gagarin*, 211.

67. Kamanin, *Skrytyi kosmos*, 1:75 (diary entry for December 6, 1961).

68. Kamanin, *Skrytyi kosmos*, 1:77 (diary entry for December 9, 1961).

69. Nikolai Kamanin, "Grazhdanin Sovetskogo Soiuza," *Aviatsiia i kosmonavtika*, no. 2 (1962): 78–82.

70. Golovanov, *Nash Gagarin*, 211.

71. Kamanin, *Skrytyi kosmos*, 1:369 (diary entry for October 29, 1963).

72. Major General Leonid Goregliad to Marshal Konstantin Vershinin, February 12, 1962; Russian State Archive of Contemporary History (RGANI), Moscow, f. 5, op. 30, d. 400. l. 23.

73. Kamanin, *Skrytyi kosmos*, 1:72 (diary entry for December 4, 1961).

74. Kamanin, *Skrytyi kosmos*, 4:252 (diary entry for January 23, 1971); 1:321 (diary entry for July 19, 1963); 1:391 (diary entry for November 28, 1963); 1:333 (diary entry for August 2, 1963); 2:9 (diary entry for January 16, 1964); 2:19 (diary entry for February 10, 1964); 2:70 (diary entry for August 17, 1964).

75. Kamanin, *Skrytyi kosmos*, 1:57 (diary entry for May 25, 1961).

76. Golovanov, *Nash Gagarin*, 191.

77. Kamanin, *Skrytyi kosmos*, 1:247 (diary entry for April 4, 1963) and 1:231 (diary entry for March 2, 1963).

78. Raushenbakh, *Prazdnye mysli*, 41.

79. Rockwell, "The Molding of the Rising Generation," 34.

80. Kamanin, *Skrytyi kosmos*, 1:58–59 (diary entry for October 4, 1961) and 1:60 (diary entry for October 17, 1961).

81. Kamanin, *Skrytyi kosmos*, 2:8 (diary entry for January 15, 1964); 1:258 (diary entry for May 6, 1963); 1:189–90 (diary entry for December 1, 1962).

82. Kamanin, *Skrytyi kosmos*, 1:98 (diary entry for March 16, 1962).

83. Baturin, *Sovetskaia kosmicheskaia initsiativa*, 166, 174–77, 194–97, 219–20, 253–55, 266–69, 281–84, 288.

84. Kamanin, *Skrytyi kosmos*, 1:224 (diary entry for February 15, 1963); 2:196 (diary entry for May 5, 1965); 1:98 (diary entry for March 16, 1962); 2:195 (diary entry for April 30, 1965).

85. Kamanin, *Skrytyi kosmos*, 4:116–17 (diary entry for January 11, 1970).

86. Cited in Fitzpatrick, *Everyday Stalinism*, 132.

87. Kamanin, *Skrytyi kosmos*, 2:61 (diary entry for July 2, 1964); 3:283 (diary entry for September 28, 1968); 2:325 (diary entry for April 8, 1966); 2:327 (diary entry for April 11, 1966); 332–33 (diary entry for April 25, 1966).

88. Eliseev, *Zhizn'—kaplia v more*, 120, 93.

89. Kamanin, *Skrytyi kosmos*, 2:26 (diary entry for March 4, 1964) and 2:40 (diary entry for April 16, 1964).

90. Kamanin, *Skrytyi kosmos*, 2:10 (diary entry for January 21, 1964).

91. Eventually Leonov agreed to the installation of the bust in his hometown of Kemerovo. See Aleksei Leonov, interview by Svetlana Samodelova, *Moskovskii komsomolets*, March 7, 2001, http://www.mk.ru/editions/daily/article/2004/05/29/111954-trete-izmerenie.html.

92. German [Gherman] Titov, "Vstrecha s Amerikoi," *Aviatsiia i kosmonavtika*, no. 7 (1962): 21–28.

93. Kamanin, *Skrytyi kosmos*, 2:326 (diary entry for April 11, 1966) and 1:332 (diary entry for August 1, 1963).

94. Kamanin, *Skrytyi kosmos*, 1:230 (diary entry for February 28, 1963) and 1:232 (diary entry for March 2, 1963).

95. Kamanin, *Skrytyi kosmos*, 2:214 (diary entry for August 30, 1965); 2:239 (diary entry for October 14, 1965); 2:250 (diary entry for November 1, 1965).

96. Yuri Gagarin et al., "The Soviet Union Must Not Lag behind the United States in Space" (1965), trans. by Slava Gerovitch, in *Living through the Space Race*, ed. William S. McConnell (Detroit, MI: Thomson Gale, 2006), 42–48. For the Russian original, see Baturin, *Sovetskaia kosmicheskaia initsiativa*, 303–6.

97. Kamanin, *Skrytyi kosmos*, 2:261 (diary entry for November 22, 1965) and 2:284 (diary entry for January 5, 1966).

98. Kamanin, *Skrytyi kosmos*, 2:262 (diary entry for November 23, 1965).

99. Vladimir Semichastnyi, *Bespokoinoe serdtse* (Moscow: Vagrius, 2002), 264–66. In May 1967, as a result of Kremlin's internal power struggle, Brezhnev forced Semichastnyi to resign, using as a pretext the scandal over Stalin's daughter Svetlana Alliluyeva's defection abroad; see Roy Medvedev, *All Stalin's Men* (Garden City, NY: Anchor, 1985), 75.

100. On the Stalin-era "Bolshevik" propaganda language internalized by individuals, see Stephen Kotkin, *Magnetic Mountain: Stalinism as a Civilization* (Berkeley: University of California Press, 1995), chap. 5.

101. John McCannon, "Positive Heroes at the Pole: Celebrity Status, Socialist-Realist Ideals and the Soviet Myth of the Arctic, 1932–39," *Russian Review* 56:3 (1997): 347.

102. See chapter 1 in this book.

103. Lewis, "The Red Stuff," chap. 4.

104. In Russian, the phrase "Poshatalis', povolynili, ni khruna ne sdelali, ele seli" is a variation on the last names of Shatalov, Volynov, Khrunov, and Eliseev; see Ponomareva, *Zhenskoe litso kosmosa*, 246.

105. Viktor Stepanov, *Iurii Gagarin* (Moscow: Molodaia gvardiia, 1987).

106. Ustinov, *Bessmertie Gagarina*, 645.

107. Scott and Leonov, *Two Sides of the Moon*, 229–30.

108. Lewis, "The Red Stuff," 161.

109. Clark, *The Soviet Novel*, 129.

110. McCannon, *Red Arctic*, 138.

111. Kamanin, *Skrytyi kosmos*, 1:347 (diary entry for September 28, 1963) and 3:205 (diary entry for April 2, 1968).

112. Lewis, "The Red Stuff," 99.

113. On April 17, 1961, just five days after Gagarin's flight, *Pravda* featured an article, titled "Unprecedented Exploit of Mastering Outer Space Inspires Soviet People to New Working Victories"; see Rockwell, "The Molding of the Rising Generation," 31. On the Stakhanovite movement, see Lewis H. Siegelbaum, *Stakhanovism and the Politics of Productivity in the USSR, 1935–1941* (Cambridge, UK: Cambridge University Press, 1990).

114. McCannon, "Positive Heroes," 350.

115. Lewis, "The Red Stuff," 158.

7. REMEMBERING THE SOVIET SPACE AGE

1. Victor Pelevin, *Omon Ra*, trans. Andrew Bromfield (New York: Farrar, Straus & Giroux, 1996).

2. Jesse Walker, Review of *Omon Ra* by Victor Pelevin, trans. Andrew Bromfield, *American Enterprise* 12:8 (December 2001): 56.

3. Asif A. Siddiqi, "Privatising Memory: The Soviet Space Programme through Museums and Memoirs," in *Showcasing Space*, ed. Martin Collins and Douglas Millard (London: Science Museum, 2005), 107.

4. Siddiqi, "Privatising Memory," 99.

5. Sergei Khrushchev, "How Rockets Learned to Fly: Foreword," in Von Hardesty and Gene Eisman, *Epic Rivalry: The Inside Story of the Soviet and American Space Race* (Washington, DC: National Geographic, 2007), xviii. See also Sergei Khrushchev, interview by author, November 18, 2011, in Gerovitch, *Voices of the Soviet Space Program*, chap. 4.

6. Aleksandr Zhelezniakov, "V Moskve otkryt pamiatnik akademiku Glushko," *Poslednie kosmicheskie novosti*, no. 206, October 4, 2001, http://www.cosmoworld.ru/spaceencyclopedia/hotnews/index.shtml?04.10.01.html.

7. Siddiqi, "From Russia with History," 5.

8. Siddiqi, "Privatising Memory," 108.

9. On memoirs of the Soviet era, see Beth Holmgren, ed., *The Russian Memoir: History and Literature* (Evanston, IL: Northwestern University Press, 2003); Irina Paperno, "Personal Accounts of the Soviet Experience," *Kritika: Explorations in Russian and Eurasian History* 3:4 (Fall 2002): 577–610; and Barbara Walker, "On Reading Soviet Memoirs: A History of the 'Contemporaries' Genre as an Institution of Russian Intelligentsia Culture from the 1790s to the 1970s," *Russian Review* 59:3 (2000): 327–52.

10. See Oleg Ivanovskii [Aleksei Ivanov], *Pervye stupeni: Zapiski inzhenera* (Moscow: Molodaia gvardiia, 1970); Ivanovskii [Ivanov], *Vpervye: Zapiski vedu-*

shchego konstruktora (Moscow: Moskovskii rabochii, 1982); Oleg Ivanovskii, *Naperekor zemnomu pritiazhen'iu* (Moscow: Politizdat, 1988); and Oleg Ivanovskii, *Rakety i kosmos v SSSR: Zapiski sekretnogo konstruktora* (Moscow: Molodaia gvardiia, 2005).

11. Ivanovskii, *Rakety i kosmos*, 164–66.

12. See Chertok, *Rockets and People*.

13. See Baturin, *Mirovaia pilotiruemaia kosmonavtika*, 209–10.

14. For an alternative account by the *Soyuz 15* crew, see Mikhail Rebrov, "Gor'kii privkus slavy," *Krasnaia zvezda* (September 9, 1994): 2; for an English translation, see "Cosmonauts Unfairly Blamed for Failure of *Soyuz-15* Flight," JPRS-USP-94-007 (October 5, 1994), 3. For details, see chapter 5 in this book, and Gerovitch, *Voices of the Soviet Space Program*, 1–3.

15. See, for example, Mozzhorin, *Tak eto bylo*.

16. khazad_dum, comment on *Taming the Fire*, January 31, 2008, and Techno_Jaro, comment on *Taming the Fire*, July 3, 2003, *Kinoexpert.ru Forum*, http://www.kinoexpert.ru/kinox/index.asp?comm=4&num=3672.

17. Iu. M. Shabalin, "Tiazhkii nedug interpretatorov," *Sovetskaia Rossiia*, April 22, 2008, http://epizodsspace.no-ip.org/bibl/sov-ros/2008/tyaj-ned.html.

18. President Vladimir Putin, speech delivered on January 12, 2007, http://www.kremlin.ru/transcripts/23995.

19. Federation Council, 199th Session, April 13, 2007, http://www.council.gov.ru/press-center/news/23084/.

20. Channel One, Announcement of the movie *Korolev*, http://www.1tv.ru/anons/id=144932.

21. Iurii Kara, quoted in *Izvestia*, October 12, 2007, http://www.pressmon.com/cgi-bin/press_view.cgi?id=2124032. In 2013 Kara started shooting a sequel to *Korolev*, and he reaffirmed the same attitude: "While working on the part of Korolev, we drew on the stories told by people who knew him personally—his daughter, cosmonauts, and co-workers. All tell very different things. But since this is an author's movie, it will present my own view of him"; Iurii Kara, interview by Anastasiia Rogova, *Argumenty i fakty*, July 31, 2013, http://www.aif.ru/culture/movie/45654.

22. Aleksei Leonov and Natal'ia Fateeva, quoted in Channel One, Announcement of the movie *Korolev*.

23. Siddiqi, *The Red Rockets' Glare*, chap. 8.

24. Siddiqi, *The Red Rockets' Glare*, chap. 5.

25. Dina Rabdel', "Kosmicheskii patriotism," *Rossiia*, May 3–10, 2007.

26. Anna Fedina, "'Koroleva' rassekretili na odin vecher," *Izvestia*, April 16, 2007, http://izvestia.ru/news/323728.

27. Rabdel', "Kosmicheskii patriotism."

28. Anonymous, comment on *Korolev*, Kinoexpert.ru Forum, June 25, 2008, http://www.kinoexpert.ru/kinox/index.asp?comm=4&num=21865.

29. Pavel73, comment on *Korolev*, Novosti kosmonavtiki Forum, April 14, 2008, http://novosti-kosmonavtiki.ru/forum/messages/forum14/topic3601/message304084/.

30. Russian Public Opinion Research Center, Press Release 612, January 18, 2007.

31. Russian Public Opinion Research Center, Press Release 1413, January 20, 2010.

32. Ivan Iudintsev, "Rossiia stremitsia v kosmos . . . na skripuchei telege proshlykh uspekhov," April 12, 2001, http://goo.gl/iohuVB. The view of Gagarin as a "national idea" is quite popular in post-Soviet Russia; see, for example, Margarita Strel'nikova, "Iurii Gagarin. 108 minut i vsia zhizn'," March 6, 2014, http://infopokrovsk.ru/v-engelse/item/4504-yurij-gagarin-108-minut-i-vsya-zhizn.

33. Vladimir Plotnikov, "Rubikon Prezidenta," *Sovetskaia Rossiia*, March 22, 2001. For a description of the mourning mood among space engineers on the night of Mir deorbiting, see Tyapchenko, interview, in Gerovitch, *Voices of the Soviet Space Program*, 123–24.

34. Valeriia Davydova et al., "40 let pervomu poletu cheloveka v kosmos!" *Novosti kosmonavtiki*, no. 6 (2001): 2. Putin also placed flowers at Gagarin's monument in Star City and met with Gagarin's family.

35. On the Soviet tradition of gift giving, particularly on gifts to political leaders, see Nikolai Ssorin-Chaikov, ed., *Dary vozhdiam/Gifts to Soviet Leaders* (Moscow: Pinakoteka, 2006).

36. Decree of the President of the Russian Federation No. 1157, July 31, 2008, http://document.kremlin.ru/page.aspx?1114088.

37. Prime Minister Vladimir Putin, speech delivered on December 22, 2009, http://archive.premier.gov.ru/events/news/8678/.

38. List of main events commemorating the fiftieth anniversary of Yu.A. Gagarin's space flight, March 17, 2010, http://goo.gl/ChKGZm.

39. Decree of the President of the Russian Federation No. 549, May 15, 2009, http://document.kremlin.ru/page.aspx?1128040.

40. Natalia Ivanova, *No$tal'iashchee: Sobranie nabliudenii* (Moscow: Raduga, 2002), 62. See also Ivanova, "No(w)stalgia."

41. Serguei Alex Oushakine, "'We're Nostalgic but We're Not Crazy': Retrofitting the Past in Russia," *Russian Review* 66:3 (July 2007): 469, 481.

42. Alexei Yurchak, "Gagarin and the Rave Kids: Transforming Power, Identity, and Aesthetics in the Post-Soviet Night Life," in *Consuming Russia: Popular Culture, Sex, and Society since Gorbachev*, ed. A. Baker (Durham, NC: Duke University Press, 1999), 94.

43. Yurchak, "Gagarin and the Rave Kids," 95.

44. See Martin Collins, "A Second Nature Rising: Spaceflight in an Era of Representation," in *Remembering the Space Age*, ed. Steven J. Dick (Washington, DC: NASA History Division, 2008), 185–202.

45. See the ads in Dmitrii Kozlov, "MTS: O iaitsakh, tarifakh, sovetskoi simvolike i butaforskikh kosmonavtakh," *Reklamnye idei*, no. 5 (2006), September 28, 2006, http://www.advi.ru/page.php3?id=287.

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50. Novosti Russian News and Information Agency, July 17, 2014, http://krsk.rian.ru/science/20140717/1016341998.html.

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52. "Putin: GLONASS dolznha byt' deshevle i luchshe, chem GPS," *Rossiiskaia gazeta*, March 13, 2007, http://www.rg.ru/2007/03/13/glonass-anons.html.

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54. Andrei Kozlov, "Voditeli popali pod podozrenie," *Vzgliad*, October 16, 2007, http://www.vz.ru/society/2007/10/16/117887.html.

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56. Russian Public Opinion Research Center, Press Release 187, April 11, 2005.

57. Cf. Valentina Nikolaeva-Tereshkova, *Vselennaia—otkrytyi okean!* (Moscow: Pravda, 1964) and Valentina Nikolaeva-Tereshkova and Viktor Khrapchenkov, *Zhenshchina veka* (Iaroslavl': Liia, 2003).

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INDEX

Academy of Sciences, 53, 55, 72, 114; cosmonaut group of, 203n125; leadership of, 120, 192n9; membership in, 9
Adams, Mark, 29
Afanas'ev, Sergei, 111, 120
Air Force, 42, 54–55, 70, 108–9, 115, 136, 145, 147, 149, 153; institutions of, 56, 103, 108–9, 141; service in, 64, 87, 131–32, 137
Air Force Engineering Academy, 108, 141, 147
Alekseev, Semen, 70, 192n9
Alliluyeva, Svetlana, 208n99
Almaz (space station), 115
Apollo (program), xiv, 6, 43, 66, 98, 126
Apollo (spacecraft), 101, 116
Apollo 1 (spacecraft), xi
Apollo 8 (mission), 23, 98, 119, 151
Apollo 11 (mission), 19, 25, 67, 121, 151; coverage in Soviet media of, 23, 179n72
Argon-11 (onboard computer), 118
Armstrong, Neil, xi, 67
Assmann, Aleida, xiii
Assmann, Jan, xiii
atheist propaganda, 4, 130, 136, 150

Baikonur (launch site), 18–19, 80, 93, 114
Bailes, Kendall, 29, 46, 50–51
Barmin, Vladimir, 36
Bashkirtsev, Andrei (movie character), 20–21
Bauman State Engineering University, Moscow, 8
Beliaev, Pavel, 63, 106, 133, 135
Benjamin, Marina, 6
Bentham, Jeremy, 185n79
Beregovoi, Georgii, 111, 151–52
Berezovoi, Anatolii, 58, 63
Bergman, Jay, 50
Beria, Lavrentii, 33
Bondarenko, Pavel, 16, 133
Bondarenko, Vladimir, 18, 131, 151
Borisenko, Ivan, 93
Boym, Svetlana, 13
Brezhnev, Leonid, 10, 34–35, 149–50, 208n99; attempted assassination of, 152; historical image of, 160, 162; jokes about, 25
Brussels World Fair, 17
Buinovskii, Eduard, 206n55
Bushuev, Konstantin, 70, 192n9
Butoma, Boris, 74, 193n22
Bykov, Iurii, 45
Bykovskii, Valerii, 57, 133, 140–41

celebrations, of space program achievements, xiii, 7, 30, 48, 129, 140, 151, 153, 162–63
censorship, xvi, 21, 23–24, 44, 68, 94, 97; self-censorship, 22, 97
Center for Deep Space Communications, Yevpatoriya, 114
Central Committee of the Communist Party, 14, 18, 23, 31, 33, 35, 37, 46, 65, 72, 74, 96, 116, 128–29, 132, 134, 140–42, 145, 179n72, 194n37, 198n111, 204n10

Central Scientific Research Institute of Machine Building (TsNIIMash), 15. *See also* Scientific Research Institute No. 88
Challenger (space shuttle), xi
Chelomei, Vladimir, 32, 39, 46–47, 158; relations with Korolev, 118, 157
Chelyuskin (steamship), 13, 50, 54
Chertok, Boris, 23, 42, 44–46, 58, 63, 72, 98, 102, 113–16, 122–23, 125, 159; as movie consultant, 19–21
Chkalov, Valerii, 78, 153, 194n29
Clark, Katerina, 15, 152
Collins, Martin, 164–65
Columbia (space shuttle), xi
Commission on Military-Industrial Issues. *See* Military-Industrial Commission
Cosmism, 4
Cosmonaut Training Center, 12, 54, 109, 124, 132, 134–35, 138, 145–47, 149, 162
Cosmonautics Day, 21, 132, 160, 162
Council of Chief Designers, 36–38, 41, 45
Council of Ministers of the USSR, 18, 31–34, 72, 75, 137, 141, 183n34
Council on Cybernetics, 55

Darevskii, Sergei, 96
Dement'ev, Petr, 74, 193n22
Demin, Lev, 115
de-Stalinization, 14, 28, 34, 152–53, 178n53

Eakin, Paul, xii
Easter, Gerald, 29
Edison, Thomas, 39
Eliseev, Aleksei, 110, 113, 115, 123, 151
Energiia Rocket and Space Corporation. *See* Special Design Bureau No. 1
Exhibit of the Achievements of the National Economy, 97, 164

Fandysh-Krandievskii, Andrei, 133
Fédération Aéronautique Internationale (FAI), 93, 197n107
Fedoseenko, Pavel, 192n14
Feoktistov, Konstantin, 36, 41, 57, 91, 122–25, 140
Fitzpatrick, Sheila, 29, 49
Flight Research Institute, 103
Ford, Henry, 39
Formin, German, 89
FSB (Federal Security Service), 167
Fürst, Juliane, 34

Gagarin, Yuri, 111, 122, 136, 147, 149, 151–52, 202n106; as celebrity, xv, 24–25, 32, 44, 48, 96, 128–29, 131–33, 135, 138–45, 174n27, 205n37; at training, 22, 53–54, 57, 59–61, 103; death of, xi, xv, 19, 25, 151–52; *Vostok* mission of, xi, xvi, 1, 47, 48, 68–97, 104, 188n35, 191n2, 194n37, 195n60; historical image of, xvii, 2, 4, 8–20, 155, 158, 162–65, 211n32, 211n34
Gagarina, Valentina, 77
Gallai, Mark, 70–71, 76–77, 79, 82, 192n9
Gemini (program), 43
Gemini V (mission), 149
Gemini (spacecraft), 101–2
Glenn, John, 147
GLONASS (GLObal Navigation Satellite System), 167
Glushko, Valentin, 20, 36, 39, 46, 181n3; historical image of, 157–58; in the Gulag, 27; relations with Korolev, 32, 156–7, 180n80
Golovanov, Iaroslav, 21, 23, 101, 138
Gorbachev, Mikhail, 156

Goregliad, Leonid, 131
GPS, 167
Grechko, Andrei, 122
Grechko, Georgii, 124
Gulag, 20, 28, 34, 161

Halbwachs, Maurice, xii
Halfin, Igal, 49
Hellbeck, Jochen, 49
Hersch, Matthew, 126
Hough, Jerry, 29
Hughes, Thomas P., 39

Iangel', Mikhail, 28, 32, 46
Iazdovskii, Vladimir, 70–71, 78, 103, 192n9
In the Shadow of the Moon (documentary), xiv
Institute of Aviation and Space Medicine, 56, 78
Ivanova, Natalia, xvii, 164
Ivanovskii, Oleg, 68, 77, 79, 158–59
Ivashutin, Petr, 72, 74, 193n22

Jenks, Andrew, 39, 139
Jones, Polly, 28, 41, 174n28

Kalmykov, Valerii, 74, 193n22
Kamanin, Nikolai, 13–4, 23–24, 50, 54–55, 67, 70–71, 73, 75–80, 84–85, 87, 92–93, 98, 105, 109, 111–3, 115, 120, 122–24, 131–47, 149–50, 152–53, 195n52
Kapustin Iar (launch site), 18
Kara, Iurii, 160–61, 210n21
Karpov, Evgenii, 12
Karpov, Iurii, 81
Keldysh, Mstislav, 70–71, 74, 120, 192n9
Kerbel,' Lev, 133, 148
KGB (State Security Committee), 25, 134, 138, 142, 145, 150, 167
Kharkhordin, Oleg, 50
Khil'chenko, Vladimir, 81
Khrabrovitskii, Daniil, 19–21
Khrunov, Evgenii, 151
Khrushchev, Nikita, xvi, 10–11, 14, 24, 28, 30–36, 39, 41, 44, 48, 50, 54, 65, 73–74, 96, 118, 128–29, 131–32, 139, 150, 153, 160, 162, 178n53, 185n79
Khrushchev, Sergei, 157
Kirillov, Anatolii, 195n52
Kohonen, Iina, 2
Komarov, Vladimir, 7, 19, 25, 110–11, 133, 151
Komov, Oleg, 19–20
Komsomol'skaia pravda (newspaper), 29
Korolev, Sergei, 30–47, 53–55, 70–75, 77–91, 93, 96, 102, 104–5, 108–9, 122, 181n1, 181n3, 195n52, 195n60; as myth-maker, 9–10, 17; historical image of, xv, 2, 7–9, 18–21, 150, 156–62; in the Gulag, 27; relations with Chelomei, 118, 157; relations with Glushko, 32, 156–7, 180n80
Korolev (movie), 160–62, 210n21
Kosberg, Semen, 84–85, 195n58
Kotovskaia, Ada, 78
Krizomazov, Omon (novel character), 155
Kubasov, Valerii, 64
Kugno, Eduard, 146–47
Kuibyshev Aviation Institute, 18
Kuznetsov, Viktor, 36

L1 (*Zond;* spacecraft for circumlunar flight), 118–19
L3 (spacecraft for lunar landing), 118–21
Laika, 7
Launius, Roger, xiv, 6, 66
Lavrov. Kirill, 21

Lavrov, Sviatoslav, 88
Lebedev, Valentin, 58, 60, 63, 124–25
Lenin, Vladimir, 10, 12, 129
Leningrad University, 56
Leonov, Aleksei (cosmonaut), 133, 135, 146–48, 152, 161, 208n91; *Voskhod 2* mission of, 62–63, 106; training for lunar mission, 118–20
Leonov, Aleksei (sculptor), 8
Lewis, Cathleen, 130, 152–53
Lilies of the Valley (song), 14

Makarov, Oleg, 119, 123
Malenkov, Georgii, 30
Malinovskii, Rodion, 136
Masevich, Alla, 94
Massachusetts Institute of Technology, 67
McCurdy, Howard, 6
McDougall, Walter, 29
Medvedev, Dmitry, 163
Mercury (program), 53–54, 108
Mercury (spacecraft), 100–1
Military-Industrial Commission, 31–33, 35, 41, 47, 53, 72, 75, 158
Mindell, David, 66, 101
Ministry of Defense, 32, 35, 38–39, 44, 47, 54, 75, 86, 142, 145, 149
Ministry of Electronic Industry, 33
Ministry of Finance, 145
Ministry of Foreign Affairs, 142
Ministry of General Machine Building, 33, 109, 111
Ministry of Heavy Machinery, 33
Ministry of Industry, 167
Mir (space station), 162–63, 211n33
Mishin, Vasilii, 36, 109, 111–12, 120–21, 123–24, 184n64
Mission Control, 62–64, 106, 112, 114–17
Mnatsakanyan, Armen, 115
Moscow University, 56
Moskalenko, Kirill, 2, 74, 93, 96, 193n22
Mozzhorin, Iurii, 33–34, 94

N1 (lunar rocket), 32–33, 35, 37, 39, 121, 151
NASA, 5–7, 31, 66, 108, 126, 176n22
Navy Engineering Committee, 63
Neisser, Ulric, xi
Neliubov, Grigorii, 1
New Soviet Man, xiv, xvi, 3, 12–13, 48–53, 55, 61, 65–67, 130–31, 133, 144, 146
New Soviet Woman, 136
Nikolaev, Andriian, 55, 105, 133, 136, 141, 152, 205n37
Nobel Prize, 44
Nora, Pierre, xiii
Novikov, Aleksandr, 122, 143

Odintsov, Mikhail, 149
Ognev, Evgenii (movie character), 20–21
Okhapkin, Sergei, 102
Omon Ra (novel), 155, 166
Osoaviakhim-1 (stratosphere balloon), 51, 53, 72
Oushakine, Serguei, 164

Pamuk, Orhan, xi, xiv
Papernyi, Vladimir, 49
Pasternak, Boris, 28
Patrushev, Nikolai, 167
Pelevin, Victor, 155
Penley, Constance, 6
Piliugin, Nikolai, 36, 118
Poletaev, Igor,' 57
Politburo, 21, 27
Ponomareva, Valentina, 43, 64, 102–3, 122
Popovich, Marina, 136
Popovich, Pavel, 55, 79, 105, 119, 133, 135–36, 141, 146, 205n37
Postnikov, Grigorii, 133

Pravda (newspaper), 134
Progress (rocket plant), 18
Putin, Vladimir, 160, 162–64, 167, 211n34

R-7 ICBM, 7, 30
Rafikov, Mars, 131
Raushenbakh, Boris, 28, 104
Red Star (newspaper), 23, 98
Riazanskii, Mikhail, 36, 45
Romanenko, Iurii, 124
Rosenberg, Emily, 5–6
Rudnev, Konstantin, 72, 74, 93, 96

Sacks, Oliver, xii
Salyut 3 (onboard computer), 118
Salyut 3 (space station), 115–16, 159
Salyut 6 (space station), 117, 124
Salyut 7 (space station), 58, 60, 63
Sarafanov, Gennadii, 115
Schattenberg, Susanne, 40
Schmid, Sonja, 64
Science and Life (magazine), 18
Scientific Research Institute No. 4 (TsNII-4), 75, 86, 93–94
Scientific Research Institute No. 88 (NII-88; Central Scientific Research Institute of Machine Building), 15, 30, 33, 94, 97
secrecy, xiv, 1–2, 11–12, 15, 17–18, 23, 25, 41, 43–45, 79, 84, 88, 93–94, 97, 104, 122, 127, 135, 138, 143, 151, 176n16, 185n80, 194n37, 195n60
Semichastnyi, Vladimir, 150, 208n99
Sharashka (prison design bureau), 20, 27
Shatalov, Vladimir, 3, 111–16, 121, 151
Siddiqi, Asif, xiii, 7, 9–11, 42, 156–58
Siegelbaum, Lewis, 17
Siemens, Werner von, 39
Skylab (space station), 127
Smirnov, Leonid, 70–71, 192n9
Solaris (movie), 24
Soyuz (spacecraft), 38, 43, 98, 107–9, 113, 116, 119, 126
Soyuz 1 (mission), 7, 19, 110–11, 151
Soyuz 3 (mission), 111, 151
Soyuz 4 (spacecraft), 3
Soyuz 4/*Soyuz 5* (mission), 110–11, 114–15, 151–52
Soyuz 6/*Soyuz 7*/*Soyuz 8* (mission), 112–13
Soyuz 15 (mission), 115–16, 159, 210n14
Soyuz 25 (mission), 117
Special Committee for Reactive Technology, 30–31, 39
Special Design Bureau No. 1 (OKB-1; Central Design Bureau of Experimental Machine Building; Energiia Rocket and Space Corporation), Podlipki (later Kaliningrad, now Korolev), 18, 32, 41–43, 62–63, 70, 88–90, 102, 104, 108–9, 118, 120, 156, 184n64
Sputnik (satellite), 4–5, 7, 10, 17, 28–30, 36, 44, 47–48, 158, 162
Sputnik 2 (satellite), 7
Stakhanov, Aleksei, 153
Stalin, Joseph, xv, xvi, 9, 13–14, 24, 27–28, 30, 33–37, 39–41, 43, 47, 50–54, 65–66, 129, 132, 150, 152–53, 156, 160, 162, 168, 187nn26–27
Stites, Richard, 140
Strategic Missile Forces, 2, 93, 149
Supreme Soviet of the USSR, 137, 146, 205n37
Suslov, Mikhail, 135

Taming the Fire (movie), 19–21, 160–62
Tarkovsky, Andrei, 24
TASS (Telegraph Agency of the Soviet Union), 22, 69, 74–75, 87, 97, 179n72

Tereshkova, Valentina, 134, 149, 152; as celebrity, 136–38, 142–43, 147, 205n37; historical image of, 4, 14, 24, 133, 168; selection of, 123; space mission of, 123
Tiapchenko, Iurii, 119
Tikhonravov, Mikhail, 22, 102
Titov, Gherman, 17, 75–76, 78, 136–37, 146–47, 152; as celebrity, 131–34, 141, 143–45, 205n37; *Vostok 2* mission of, 12
Tomoff, Kiril, 29
Tsander, Fridrikh, 7
Tsiolkovskii, Konstantin, xiii, 7–10, 161, 167
Tsybin, Pavel, 102
Tyuratam (launch site). *See* Baikonur

Ustinov, Dmitrii, 21, 36–37, 39–40, 65, 72, 74
Usyskin, Il'ia, 72, 192n14

Vasenko, Andrei, 192n14
Vershinin, Konstantin, 74, 136, 193n22
Vetrov, Georgii, 38
Vodop'ianov, Mikhail, 50
Volynov, Boris, 151
von Braun, Wernher, 135
Voskhod (mission), 123, 134, 151
Voskhod (spacecraft), 61, 91, 105
Voskhod 2 (mission), 62–63, 105–7
Voskhod 2 (spacecraft), 102, 105
Voskresenskii, Leonid, 70, 81, 192n9, 195n52
Vostok (mission), 68–97, 158, 163, 194n37
Vostok (rocket), 101
Vostok (spacecraft), 17, 31–32, 37–38, 41–43, 48, 53, 61, 68–93, 100–5, 107–8, 125–26
Vostok 3 (mission), 55, 105
Vostok 4 (mission), 55, 105
Vostok 5 (mission), 57
Vostokov, Fedor, 79

Walker, Barbara, 29
Wertsch, James, xiii
Wonder of It All (documentary), xiv

Yurchak, Alexei, 164

Zenit (reconnaissance satellite), 42, 125
Zenit-2 (reconnaissance satellite), 97
Zhukov, Georgii, 25
Zond. *See* L1
Zubkova, Elena, 50